INTERNAL CONSISTENCY OF PRO ENVIRONMENTAL ATTITUDE QUESTIONNAIRE ITEMS

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ABSTRACT

Discovering the innumerable dimensions of human behavior is vital for a stronger commitment for clean and healthy environment. Pro-environmental attitude refers to a person's collection of beliefs, intentions and affects towards the environment. Any systematic endeavor to understand, predict or endorse pro-environmental attitude requires an adequate measurement tool for the assessment. Exploring the internal consistency of the items with the help of statistical measures is critical for meaningful production of such assessment tool. Cronbach's alpha is the widely used statistical tool for ensuring internal consistency. The aim of this study is to determine the internal consistency of the 55 items of pro-environmental attitude questionnaire developed by Dr. D.D. Roy (2020) with the help of cronbach's alpha (α). To serve this purpose, data was obtained from individuals (n=129) of various rural, urban and semi urban locations by using non-probability sampling technique. Further, the cronbach's alpha (α) was carried out for the items using R. The cronbach's alpha for 55 items was 0.87 initially. The calculation of correlation between item and total scores reveales nine poorly consistent items and hence were removed. High internal consistency was reported among the remained 46 items (α_{46}=0.88). Again, high item total correlation was obtained for ten items and alpha was reported as 0.85. Hence, the 46 item version can be considered for measuring pro environmental attitude and the 10 item version can be used as the shorter version of the original. Based on the results further scope for alike investigations were suggested.

Keywords: Pro-environmental attitude, Internal consistency reliability, Cronbach's alpha, Item toal crrelation

1. INTRODUCTION

1.1. Pro environmental attitude

With the rise of global environmental issues, understanding environmental attitudes has become vital for addressing many applied environmental problems, ranging from local issues like water pollution to global issues like climate change. According to Milfont and Duckitt, Environmental Attitude (EA) is defined as psychological tendency expressed by evaluative responses to the natural environment with some degree of favor or disfavor (Milfont and Duckitt, 2010). Schultz described EA as the collection of beliefs, affect and behavioural intentions a person holds regarding environmentally-related activities or issues (Schultz et al. 2004). Pro environmental attitude refers to the latent construct comprising of nine (9) domains viz. cleanliness, safety, sensitivity to environmental impact, perceived control, self regulation, social support, reductionism, recycling, reuse and conservation and they can be defined as follows:

- **Cleanliness**: to what extent the individual feels the surrounding clean, tidy and free from pollutants.
- **Safety**: to what extent a person uses the practices, policies and procedures that ensure one's well-being and safety in the immediate environment.
- **Sensitivity to environmentel impact**: to what extent a person reacts when exposed to tempted products, cleaning products, laundry detergents, paints, petrochemicals, cigarette smoke, pesticides, pets, plants etc.

- **Perceeived control**: to what level one can determine his own behavior to bring about favourable outcomes in environment.
- **Social support**: to what extent availability and assistance from other people help in the improvement of the envionment.
- **Recycling:** to what extent an individual is ready to convert waste material into new materials and objects.
- **Reuse**: to what extent one wants to use an object or resource material again for either the same purpose or another purpose without changing the object structure in a significant way.
- **Reductionism**: to what extent environmental reduction influece one's behavior.
- **Conservation**: to what extent one protects, prevents, manages or restore natural environment and ecological communities.

Attitudes are not directly observable and hence it is measured by inferring directly observable responses. Direct self-report techniques, such as scales and inventories, are the most widely used methods for measuring environmental as well as pro-environmental attitude and behavior. Dutta Roy developed a Pro-environmental attitude questionnaire (Roy, 2020) containing a total of 55 items covering all the nine domains of pro- environmental attitude. However, there has not been any prior study found that investigated the iternal consistency of the items in the questionnaire. The present study attempts to explore the internal consistency for 55 itmes of the questionnaire by calculating cronbach's alpha (α) for each item.

1.2. Internal consistency of a psychological test

Evaluating the internal consistency of a psychological test is the key concern before moving on to testing for the efficacy of interventions. For a psychological questionnaire to be called as psychometrically sound, it must follow the most basic assumptions of checking the reliability of the questionnaire (Cohen et al., 2014). Reliability has been defined as "the consistency of scores obtained by the same persons when they are re-examined with the same test on different occasions or with different sets of equivalent items, or under variable examining conditions" (Anastasi & Urbina, 1997). Internal consistency reliability contributes to ensuring the reliability of the instrument by estimating whether the items reflect the same construct yield similar results. Determining the internal consistency of a test before it is employed for the purposes of research or examination is important to ensure validity. There are a wide variety of internal consistency reliability estimates, for example, Cronbach's alpha (Cronbach, 1951) and Kuder-Richardson formula 20 (Kuder & Richardson, 1937).

1.3. Cronbach's alpha (α)

Cronbach's alpha (α) is perchance the most frequent estimate of internal consistency of items in a scale (Cronbach, 1951; Cronbach & Shavelson, 2004). It was developed by Lee Cronbach in 1951 and used to assess the internal consistency of questionnaire items (Cronbach, 1951). The coefficient alpha indicates the ratio between the true score variance on a test and total variance. In other words, α calculate approximately the proportion of variance that is organized or consistent in a set of survey responses (Vaske et al. 2017).The

procedure is to compute the variance of all individuals' scores for each item, and then to sum the variances of these across all items.

The cronbach's alpha conventionally ranges from 0.00 - 1.00. A negative value occures when the items are not positively correlated. Typically, an alpha of .65–.80 is often considered "satisfactory" for a scale used in human dimensions research (Green et al., 1977; Spector, 1992; Vaske, 2008). A positive correlation is assumed among the items of a scale to as they are measuring the same theoretical concept. A negative value of α indicates that the items are not positively correlated (Ritter, 2010). In such condition, one or more items may need to be recoded so that all the items denotes same conceptual framework. A negative correlation, however, can also be the result of inconsistent responses of the respondents (Thompson, 2003).

Internal consistency is apprehensive of the interrelatedness of a collection of test items, whereas homogeneity refers to unidimensionality. Internal consistency is a necessary condition to measure homogeneity or unidimensionality of test items; however, it is not sufficient alone (Cortina, 1993, Green et al., 1977). An alpha value near 1 is, therefore, indicative of high internal consistency of the items and not unidimansionality.

This study investigates the cronbach's alpha for the 55 items of a pro-environmental attitude questionnaire. All the items are in the form of a 5 point likert scale of score ranging from 1 to 5 (1 is for "strongly agree", 5 is for "strongly disagree"). Cronbach's alpha is the widespread estimate of internal consistency for likert scale (Vaske et al. 2017). Hence, in the present study, cronbach's alpha is used as a measure of internal consistency of the items.

1.4. Objective

In the process of psychological test construction, measuring the internal consistency of the items is a fundamental issue. Cronbach's alpha is the most commonly used statistic to measure the internal consistency among the items. In the present study the questionnaire developed by Dutta Roy in Psychology Reserch Unit of Indian Statistical Institute, Kolkata has been taken into account. There are a total number of 55 items in the questionnaire. The single objective of this study is to determine the internal consistency of Pro-environmental attitude questionnaire using croanbach's alpha (α).

2. LITERATURE REVIEW

2.1. Understanding and measuring pro-environmental attitude and behavior

There are a large number of factors that are held responsible for causing environmental issues such as environmental pollution, change in climate, biodiversity loss, occurance of biohazards etc. Human behavior is also considered as one of the major contributor of such issues (Wynes & Nicholas, 2017). Therefore, to address and mitigate those environmental issues, a clear understanding of human attitude and behavior is very important. This class of human behavior has been studied under different disciplines at times. Environmental psychology has been one of the most popular disciplines in this perspective (Steg & Vlek, 2009). Environmental attitudes are the fundamental construct in environmental psychology. Pro environmental attitude is a latent construct which is made up of different dimensions.

Attitude is covert and can be analysed only by obseving various human behavior. To analyse the underlying mechanisms and psychological correlates of pro-environmental attitude (PEA), one needs to measure its various domains systematically. Likewise, a systematic assement of target behavior can induce effectivness in the iterventions of promoting PEA. In this review of literature, a number of such approaches have been discussed. Starting from the review of self-report measures, field observation methods, and laboratory experiment method will be discussed.

In self-report assessment, individuals are asked to give information about the nature of behaviors they perform in their daily life. Individuals can respond in

interview format, via e-mail or via telephone and through responding to online questionnaires. Self report questionnaires are very effective for large scale surveys as it can provide a large number of data at low cost and minimum time. In self report assessment, various behavioral properties can be targated. In some questionnaire authors rely on single item whether multi item questionnaires are also popular among another community of authors. Multi item scales are of the advantage of loe measurement error (Lange and Dewitte, 2019). Diversity is seen among the multi-item scales used for measuring Pro-environmental behavior (PEB). Most of these scales are ad hoc and are developed for particular resesarch projects. This type of scales lack proper psychometric quality (Dono, et. al, 2010).

However, some other researchers produce PEB scales on the basis of a precise psychometric analysis of item and scale properties. Such practice offers evidence-based confidence to the research community to use the same validated scale. A good number of these scales have been designed to assesss the individual tendency to indulge in pro-environmental behavior across various domains. General Ecological Behavior (GEB), on the basis of using frequency and diligence of psychometric evaluation, can be considered as the best of such category scales (Kaiser, 1998; Kaiser & Wilson, 2004). Moreover, some other scales are also there which focuses on particular populations, contexts and particular domains of PEB (Evans et al., 2007, Boiral & Paillé, 2012, Alisat & Riemer, 2015).

With an ample amount of advantage, self report measures are often questioned about its validity (Gifford, 2014; Lange, Steinke, & Dewitte, 2018). Another limitation includes subjectivity of responses. Partiality bias may occure as

individuals tends to give desirable responses so that they could meet the expectations of the researchers (Lange and Dewitte, 2019). Lastly, self-report measures are difficult when it comes to using for experimental PEB studies (Lange et al., 2018).

In view of such limitations, other measures are used to assess PEB. Field observations of PEB assure a certain level of objectivity as they acquire information through direct observation. According to Kormos and Gifford (2014), obsevation can be conducted through informants, trained observer and device measurements. Informant reports are acquired from well-acquainted others, such as friends, spouses, or co-workers of the target individual (Vazire, 2006). Informents are asked to give an account of target individual's casual behavior (Seebauer, 2017) or to observe them delibarately and reprt behavior (Lam & Cheng, 2002). Here also subjectivity of response could occure as limitation. For improving objectivity, informants are trained and inter rater reliability could be calculated for more than one informants (Chao and Lam, 2011). Another measure to avoid such subjectivity is to be observed by an unrelated expert observer. The researcher itself could do the observation in natural settings. In this set up one must be very careful as knowledge about the observation may induce reactance in the target individual (Meleady et al., 2017). In device measurements, researchers can also illustrate from a variety of technical devices. Commonly these devices directly do not assess PEB but rather they assess a PEB product. Household consumption like electricity, gas, and water are some of the popular variable for device-mediated measurement. These data can be acquired by visiting participating households and monitor their utility (Schultz et al., 2016, Gregory & Di Leo, 2003).

2.2. Pro- environmental attitude scale development and Cronbach's alpha

Construction of tests to measure attitudes is an obvious practice for beahavioural scientists. There are various multiple item tools that have been devised time to time by several researhers aiming measurement of pro-environmental attitude. The comprehensive review of literature on use of cronbach's alpha to check the internal consistency reliability of pro-environmental attitude scale revealed that it is more of a routine work and common to most of the scales. In an attempt to device a questionnaire to measure the environmental behavior and attitude of university students, cronbach's alpha was used as the measurement of internal consistency. The 31 item questionnaire using 5 point likert scale response had showed cronbach's alpha 0.803 for attitude (Erzengin and Teke, 2013). In the development of the Pro-Environmental Behavior Scale (PEBS), cronbach's alpha of the whole scale is found to be 0.76, whether coefficient of alpha for subscales are ranging from 0.62 to 0.74 (Markel, 2013). The Environmental Attitude Inventory (EAI) developed by Milfont and Dukkit was a 120 item inventory by origin which was later redeviced by reducing items from 120 to 72 and then 120 to 24 respectively. The coefficient of alpha, however, for 24-item version was evaluated and found to be 0.83 (Ajdukovic et al., 2019). Another popular practice among the researchers is developing attitude scale as per the convenience and viability of the sample. In such cases, some new items are introduced to the pre-existing environmental attitude items. These new versions of scales are then tested for their reliability. In one such attempt, an environmental attitude scale was made with 19 items where 3 items were original and was made only for that study purpose and the other 16 items were

fom 7 different pre-existing scales. The internal consistency of the whole items, then, was tested using cronbach's alpha and found to be 0.88 (Heyl et al., 2013).

The studies presented in the upper section has discussed about the measurement of pro environmental behavior on the bsis of various measurement techniques and use of cronbach's alpha (α) to test the internal consistency of various environmental and pro-environmental attitude scales. The discussion led to a conclusion that self report measure is being used widely to measure pro-environmental attitude and behaviour. In statistical analysis, cronbach's alpha (α) is an obvious practice for testing the internal consistency among the items.

3. METHOD

3.1. Sample characteristics and data collection procedure

The present study aims to collect data on pro environmental attitude by using pro environmental attitude questionnaire (Apendix 1) developed by D. Dutta Roy (Roy, 2020). The questionnaire was converted using 'Google form' and was sent to individuals through WhatsApp and E-mail. An online survey was conducted from 4th May to 20th May 2021 to collect the information. An informed consent was also attached with the google form and the participants provided full consent before participating in the online survey (Appendix 2). A total of 129 participants had participated in the survey from various locality and they had provided complete information regarding the survey. Sufficient time was given to respondents to read, comprehend and answer all the questions.

The data was collected from 129 participants of various locality out of which approximately 60.5% participants are from urban area followed by rural (25.6%) and semi urban (14%). All the participants are of age group 18-65 with mean age 27.80. Most of the participants are from psychology specialization (38%) and reading (34%) is the mostly persued hobby. The minimum educational qualification for the participant is under graduate where the maximum is P.hD. number of post graduate participants are highest, i.e. 53%. All the demographic details of the participants are depicted in pie chart in figure 2(a, b).

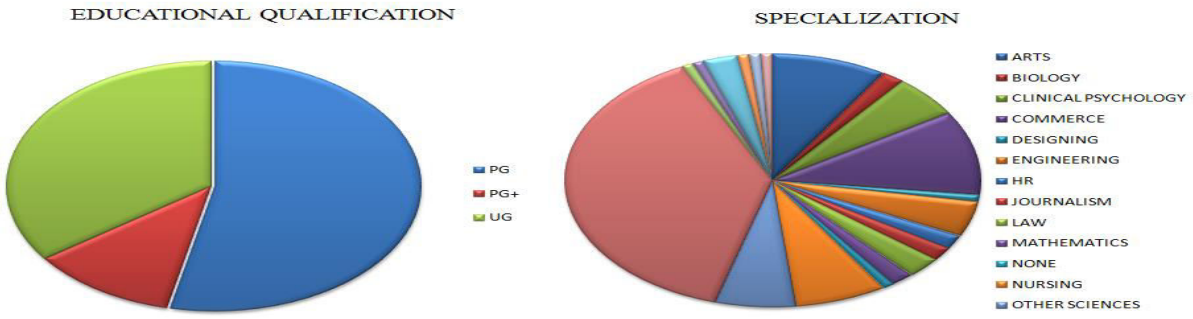

Figure 1(a): Educational qualification and specialization of participants

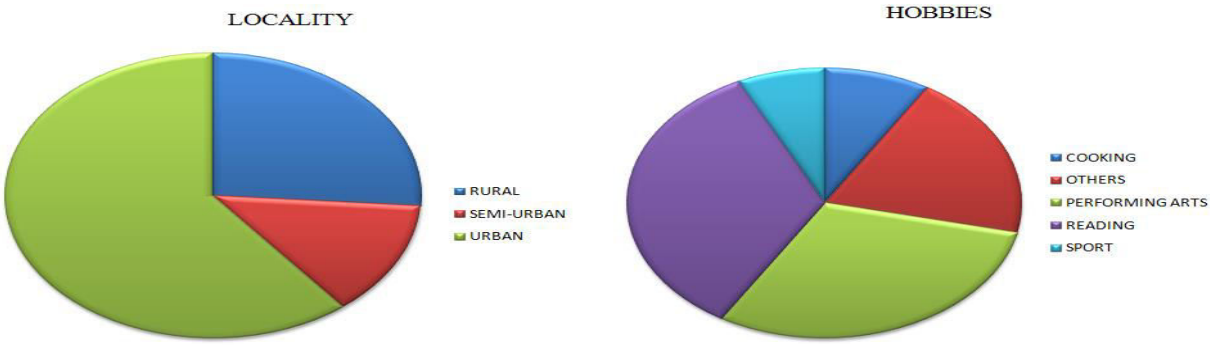

Figure 1(b): Locality and Hobbies of the participants

3.2. Description of tool

To assess the pro-environmental behaviour, questionnaire based on self-reported behaviour was used. The instrument was adapted from pro environmental attitude scale developed by D. Dutta Roy which comprises nine domains and 56 items (Roy, 2020). The item questionnaire was divided into two parts including participants' personal information (9 items) in the first part. The 56 items in the questionnaire are unevenly distributed domainwise. Table 1 represents the number of items domainwise and their serial number in the questionnaire.

Table 1: Domainwise distribution of items

Domains	Quantity of items	Sl no.
Cleanliness (CLE)	6	1,9, 17,33,41,53
Safety (SR)	7	3,11,19,27,35,44,51
Sensitivity to environmentel impact (SEI)	7	2,10,18,26,34,42,50
Perceived control (PC)	1	12
Social support (SS)	6	4,28,36,37,43,52
Recycling (REC)	7	6,14,22,30,38,46,54
Reuse(REU)	7	7,15,23,31,39,47,55
Reductionism(RED)	6	5,13,21,29,45,49
Conservation(CON)	9	8,16,20,24,25,32,40,48,56

All the questions in the domains are in the format of a 5 point Likert Scale ranging from strongly agree (score 1) to strongly disagree (score 5). One item from the cleanliness domain was excluded and a total of 55 responses were taken into consideration.

3.3. Data analysis

The obtained data was compiled using Microsoft Excel 2013 and Google Sheets. All the statistical analyses were compiled using R compiler version 4.0.5. The demographic profiles of the data collected were analysed by using percantage formula and were depicted in pie diagrams. There was a repeated item (item 9) is in the questionnaire which has been removed. The tool contains 55 items with 5 point likert scale. Therefore, the scores could range frome 55 to 275 with a mean score of 3.92. A row wise mean was calculated for the data and then Box whiskar plot has been drawn for removing the outliers in the whole data. There were three outliers which were located by ‘locator ()’ function and

was removed. After the removal of the outliers the final data remains of size 126. Figure 1 depicts the Box- Whisker plot of the row wise mean of the data before and after removing the out liers.

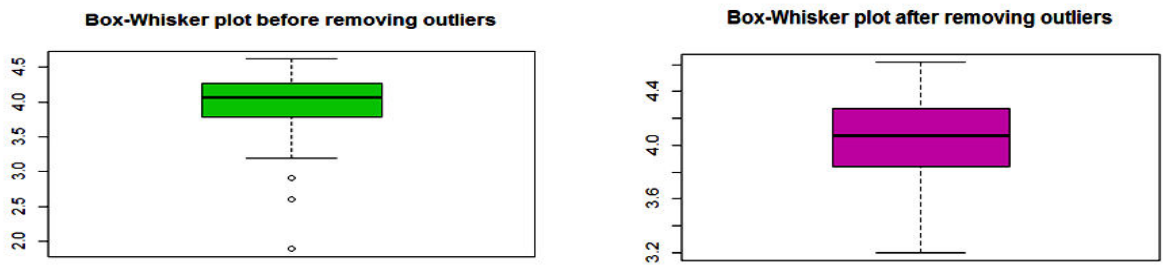

Figure 2: Box- Whisker plot of the row wise mean of the data

After removing the outliers, Coefficient of alpha or cronbach's alpha (α) was calculated for the 55 items in the questionnaire by using these new data.

3.3.1. Obtaining coefficient of alpha (α)

Furthermore, coefficient of alpha for the items was calculated. The formula for cronbach's alpha or coefficient of alpha is (Cronbach, 1951, Arifin, 2018)

$$\alpha = \frac{K}{K-1}[1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_{total}^2})]$$

Where, K = the number of items in the scale, $\Sigma\sigma_i^2$= is the sum of the k item score variances and σ_{total}^2= is the total score variance of measurement. To calculate the Cronbach's alpha, at first the variance for individual item has to be calculated and then summing up these variances will give the $\Sigma\sigma_k^2$. Next, for the calculation of total score variance (σ_{total}^2), the total score on individual items needs to be calculated and then their variance can be obtained by the formula (Thompson, 2006, Wright, 2013)

$$\sigma_{total}^2 = SOS_{total} / (n - 1)$$

Where, ‘SOS’ means the sum of squares and ‘n’ denotes the number of items. Later on cronbach’s alpha was also calculated for each dropped item. Calculating alpha if item deleted will give the opportunity to examine whether with the deletion of item, the alpha value also get affected or not. For example, if after deleting an item alpha gets higher than the total scale alpha, the item can be removed permanently from the scale, so that the scale can exhibit its highest internal consistency. In the next section all the results of this investigation are discussed.

The next strategy was to calculate the item-total score corelation to see whether the items are consistent with the total item score or not. Pearson’s correlation formula was used as the measure for calculationg correlation coefficients (r). Futher, p-values for r gives the significance of the relationship between the items and the total scores.on the basis of item total correlations highly consistent items will be segregated and cronbach’s alpha for the newer version of scale will be calculated again.

4. RESULT

4.1. Estimating cronbach's alpha (α)

The aim of the present study is to obtain cronbach's alpha (α) of the items of pro environmental attitude questionnaire developed by Dr. D. D. Roy. An examination of coefficient of alpha for 55 items considered together revealed an alpha value α_{55}=0.87 (mean=4, and standard deviation (sd) =0.33).

4.2 Item analysis

With regards to the consistency of the items, the item analysis covered by item-total correlation and Cronbach alpha values if respective item is deleted was examined. It is observed that there are nine items, which are depicted in table 2 with their respective correlation coefficient and p-values, indicating very low and non significant correlation with the total scores.

Table 2: The correlation coefficient and p-values for the nine non significant items (N=126)

Item name	Item	Correlation coefficient (r, df= 124)	P-Value
B	Nature is important because of what it can contribute to the pleasure and welfare of humans.	0.08	0.39
C	I do not believe protecting the environment is an important issue.	0.13	0.16
K	Humans will eventually learn enough about how nature wOorks to be able to control it.	0.09	0.38
L	The balance of nature is very delicate and easily upset.	0.07	0.32
O	We should conserve environment even if peoples' welfare suffers.	0.13	0.14
P	Loss of goods occurs due to regular dusting.	0.11	0.17
I1	Authority provides little fund to conserve the environment.	0.15	0.10

N1	Dusting increases productivity.	0.12	0.11
V1	The Earth has plenty of natural resources if we just learn how to develop them.	0.15	0.10

Though each of these items is related to the attitude towards environment, yet their poor consistency was reported by the results of item total correlation. Unfortunately, these items were considered to be poorly constructed and we have to remove them. Other 46 items has item total correlation coefficients ranges from 0.25-0.71 (p value < 0.05) which is significant.

An examination of coefficient of alpha was again performed for the remaining 46 items and results revealed a standard alpha value α_{46}=0.88 (mean= 4.1, and standard deviation = 0.38). The sum of item variance ($\Sigma\sigma_k^2$) for the whole scale is 45.74 and the total variance (σ_{total}^2) is 300.62. The ideal range for Cronbach's alpha coefficient is 0 to 1, though there is no lower limit. As the value of α become closer to value 1, the internal consistency of the scale gets higher (Gliem and Gliem, 2003). Hence, the internal consistency of the scale is icreased by 0.01 with the removal of poorly consistent items. the estimation of alpha if respective item is deleted ranges in between 0.88-0.89, which is again satisfactory in terms of individual item removal. The standard error of alpha is 0.017 and the average correlation between the items is 0.14 for the new version the scale with 46 items. Moreover, the examination of p-value reveals that there is significant correlation between each item and total scores (p-value < 0.05). Table 3 depictes the mean, standard deviation, item total correlation (in descending order) and p-values of 46 items.

Table 3: Mean, standard deviation, item total correlation coefficients (in descending order) and p-values of 46 items (N=126)

Name of items	Items	Mean	Standard deviation	Item total correlation coefficient (r, df=124)	p-value
L1	I am willing to change my lifestyle to reduce environmental damage.	4.36	0.75	0.74	< 2.2e-16
U1	I intend to save natural resources whenever possible.	4.40	0.82	0.60	1.14E-13
C2	I try to find ways to conserve power in daily life.	4.33	0.75	0.60	7.00E-14
D1	I prefer materials that can be reused.	4.44	0.73	0.57	4.96E-12
Y	I prefer using dustbins instead of littering on the street.	4.73	0.70	0.56	1.02E-11
O1	I think compassion towards animals is necessary.	4.44	0.80	0.56	4.20E-10
M	Recycling is hectic and inconvenient.	4.17	0.91	0.54	9.75E-11
R1	Segregation of waste materials is inconvenient.	3.93	1.01	0.54	9.77E-11
Y1	Plants and animals have as much right as humans to exist.	4.64	0.78	0.54	4.36E-11
V	Reuse helps protect environment.	4.48	0.65	0.51	1.06E-09
P1	People should carry out Government's recommendation to control global warming.	4.47	0.65	0.49	4.55E-09
A2	It disgusts me to see recyclable things thrown away.	4.13	1.00	0.49	8.13E-09
N	Reuse preserves resources.	4.42	0.66	0.48	1.71E-08
B1	When humans interfere with nature it often produces disastrous consequences.	4.30	1.03	0.47	2.31E-08
S	Regular environment awareness programs can help conserve the natural environment.	4.33	0.85	0.46	6.55E-08
W1	I think using solar energy is inconvenient.	4.04	1.17	0.46	6.93E-08
K1	Humans have the right to modify the natural environment to suit their needs.	3.88	1.24	0.45	1.62E-06
A1	I prefer to use separate waste bins for recyclable and non-recyclable products.	4.24	1.01	0.44	2.15E-07
X1	I am willing to consider other ways of making the environment better.	4.40	0.76	0.43	4.09E-07
U	Recycling prevents buying new materials and protects environment.	4.21	0.93	0.42	1.26E-06
J1	Different sections in the institution should provide different waste bins.	4.06	1.09	0.41	1.62E-06

S1	Recycling a product reduces its productivity and quality.	3.71	1.20	0.39	8.38E-06
G	I am enthusiastic to use old goods provided by others.	3.33	1.23	0.38	1.05E-05
J	I prefer to change the things if it adversely affects the environment.	4.41	0.79	0.38	1.50E-05
H	Conservation lowers peoples' standard of living.	4.10	1.10	0.37	2.10E-05
Z	As soon as I see an environmental problem, I start looking for a possible solution.	3.76	0.94	0.37	2.36E-05
H1	I have a hard time setting goals relating to environment.	3.33	1.12	0.37	2.27E-05
Q1	Plants are taken care of in this institution.	3.96	1.03	0.37	2.33E-05
Z1	Humans are seriously abusing the cleanliness of the environment.	4.44	0.96	0.37	1.90E-05
Q	Participating in decision making process helps one to be aware of the environment.	4.21	0.79	0.34	8.64E-05
G1	I am not bothered by deforestation.	4.39	1.04	0.32	3.05E-04
T1	I prefer not using plastics even if there are no alternatives.	3.59	1.08	0.32	2.52E-04
M1	I am not bothered to save water.	4.63	0.88	0.31	3.58E-04
C1	Recycling plastics help the environment.	4.32	0.94	0.30	5.88E-04
F	Industry should be required to use recycled materials even when this costs more than making the same products from new raw materials.	4.02	0.99	0.28	1.40E-03
I	Saving one plant instead of cutting reduces global warning.	4.49	0.89	0.28	1.52E-03
R	I prefer sticking to a plan that works according to my needs.	2.53	1.09	0.28	1.55E-03
E1	Environment should be protected for wellbeing of plants and animals rather than humans.	3.29	1.34	0.27	2.40E-03
B2	I think using bottles to plant trees help environment.	3.52	1.17	0.27	2.52E-03
A	I think spending time in maintaining a clean household is boring.	4.06	1.16	0.26	1.05E-05
X	The balance of nature is strong enough to cope with the manmade changes in the environment.	3.25	1.26	0.26	3.04E-03
E	It is better to use roof, balcony and windows for gardening.	3.75	1.06	0.24	6.74E-03
T	The so-called "ecological crisis" facing humankind has been greatly exaggerated.	3.72	1.29	0.24	7.89E-03
W	Loss of rainforests restricts development of new medicines.	3.54	1.11	0.24	7.69E-03
F1	Maintaining cleanliness is time consuming.	3.71	1.30	0.22	1.19E-02

D	It is possible to improve quality of care if Governmental guidelines are provided.	4.00	1.00	0.21	1.89E-02

Again, among these 46 items, there are 10 items (item M, V, Y, D1, L1, O1, R1, U1, Y1, C2 placed at the top in table 3) that showed high item-total correlation ($r(124) \geq 0.5$, $p < 0.01$, where, df=124) which signifies that these items are so well constructed that they can illustrate the pro environmental attitude well. Therefore, calculation of cronbach's alpha for these items was performed. Result suggested an alpha value of 0.85 which is lower than the alpha value of 46 item version. The inter-item correlation for these items is shown in table 4. The inter-item correlation for each item in 10 item version ranged from 0.17 to 0.59. All the correlation coefficients were positive and therefore can be conceptually fit together. Items O1, M,V and U1 has the lowest correlation, i.e 0.17 while most of the items have showed correlation in the range of 0.4-0.6 which is moderate as evidenced by available literature. In case of three items (item O1, V and M) exhibiting poor inter item correlation ($r(124) < 0.2$, where df =124), it is found that the correlation is also non significant (p-value > 0.05).

Table 4: The inter item correlation of 10 highly related items (N=126)

	L1	U1	C2	D1	Y	O1	M	R1	Y1	V
L1	1.00									
U1	0.59	1.00								
C2	0.53	0.56	1.00							
D1	0.38	0.42	0.40	1.00						
Y	0.57	0.43	0.50	0.26	1.00					
O1	0.48	0.58	0.33	0.24	0.45	1.00				
M	0.44	0.17	0.21	0.28	0.21	0.17	1.00			
R1	0.40	0.27	0.32	0.36	0.30	0.27	0.28	1.00		
Y1	0.42	0.46	0.26	0.25	0.35	0.42	0.23	0.22	1.00	
V	0.36	0.29	0.42	0.47	0.25	0.17	0.38	0.37	0.26	1.00

The mean, standard deviation, item total correlation for the 10 items is depicted in table 5.

Table 5: Mean, Standard deviation (SD), item-total correlation coefficients and p-values for 10 items. (N=126)

Item name	Item	Mean	SD	Item total correlation coefficient (r,df = 124)	p-value
L1	I am willing to change my lifestyle to reduce environmental damage.	4.36	0.75	0.80	< 2.2E-16
U1	I intend to save natural resources whenever possible.	4.40	0.82	0.73	< 2.2E-16
C2	I try to find ways to conserve power in daily life.	4.33	0.75	0.68	< 2.2E-16
D1	I prefer materials that can be reused.	4.44	0.73	0.62	9.51E-15
Y	I prefer using dustbins instead of littering on the street.	4.73	0.70	0.65	< 2.2E-16
O1	I think compassion towards animals is necessary.	4.44	0.80	0.63	1.6E-15
M	Recycling is hectic and inconvenient.	4.17	0.91	0.54	7.812E-11
R1	Segregation of waste materials is inconvenient.	3.93	1.01	0.61	2.638E-14
Y1	Plants and animals have as much right as humans to exist.	4.64	0.78	0.60	1.78E-13
V	Reuse helps protect environment.	4.48	0.65	0.60	1.231E-13

So, it can be stated that these 10 items are highly correlated to their total scores and exihibit good internal consistency ($\alpha_{10} = 0.85$). Moreover, the alpha when respective item is deleted ranges between 0.81- 0.85 depicting no significant change in alpha value with deletion of items. Hence, the scale with these 10 items can be used as a shorter version of the pro-environmental attitude scale.

5. DISCUSSION

The primary purpose of this study was to calculate the cronbach's alpha (α) of the Pro-environmental attitude questionnaire developed by Dr. D.D. Roy so that the internal consistency of the 55 items could be obtained. For doing this, the cronbach's alpha and item to total score correlation for all the 55 items were calculated. The alpha was found 0.87 whether nine items were found to be not significantly correlated with the total scores. These items belong to different domains and were constructed for measuring various domains of pro-environmental attitude. Though each of these items is related to the attitude towards environment, yet they have been removed from the scale in view of their poor consistency. A non significant correlation between the item and total score states the poor consistency of the items. Hence, cronbach's alpha for the remaining 46 items were examined again. A rise in the internal consistency by 0.01 was reported among the scale items ($\alpha_{46} = 0.88$). The p-value of 46 items shows significant correlation between item and total score. Thus, it can be suggested that the remaining 46 items are highly consistent. However, results of item total corelation among these 46 items also illustrated 10 highly correlated items ($r > 0.5$). For this, alpha was again calculated for the 10 items and was reported to be 0.85. Further, examination of inter item correlation for these 10 items to see whether they exhibit unique variance or not, gives satisfactory results. The item-total score correlation for these 10 items was also indicative of their suffuciency for measuring the pro-environmental attitude. As suggested by available literature on reliability testing, internal consistency coefficients has been recognized for estimating the degree of scores measuring the same concept (Ritter, 2010). Calculation of alpha for 46 items gives a high value of 0.88 which implies that the items are sufficient together to measure the same latent

construct, i.e. pro-environmental attitude of target individuals. Again, in case of highly correlated 10 items, it can be clearly visible that they exhibit a good internal consistency coefficient and hence can be used as the shorter version of the original pro-environment attitude questionaire.

However, examining the internal consistency if individual items are removed from the scale is also can be critical for stating the reliability of the scale. There are various examples of instances where the researchers have stated the reliability in terms of the items of a test as a whole. But when such a scale was used for measureent and the analysis was done on the basis of individial items, it showed inconsistent results (Gliem and Gliem, 2003). In the present study, persistence of alpha value with removal of individual items indicates the good reliability of each. Though, the index “alpha if item deleted” acts as a crucial measure for some researcher, yet, a group of researcher condemned it for loosing criterion validity in the process of increasing the coefficient of alpha (Raykov, 2008). Meanwhile, highly significant p-values of item total correlations can give a clear picture of the consistency of the items. Items poorly correlated to total scores, thus can act as an indicator while estimating the overall internal consistency of a scale.

Despite the fact that the alpha value is very high for the questionnaire, the study exhibits the limitation of low sample size. With a very limited sample size the data is not normally distributed and negatively skewed (Appendix 3). A low sample size can not strongly represent a particular population. So, re investigating with a large sample may increse the generalizability of the questionnaire. Moreover, choice of sampling technique may also be viewed as another limitation of this study. Due to the present lockdown condition owing to

the COVID 19 emergency in the country, online surveys are the only possible means of data collection. So, convenience sampling is the best choice. In convenience sampling technique, possibilities over under or over representation is very normal and hence collection of data with probability sampling technique may have yield different and more generalizable results. However, offline data collection can be considered as another opportunity for the researcher to make direct observation of the participants and hence can contribute to increase the objectivity of the responses.

6. CONCLUSION

This study presents the coeeficient of alpha or Cronbach's alpha (α) of pro environmental attitude scale items developed by Roy (Roy, 2020). The survey was carried out on a dataset of sample size 129 but 3 outliers were identified and removed and the final size of the data is 126. The item – total correlation coefficient and cronbach's alpha was calculated for the whole 55 items. Nine items were found to be poorly consistent with the total scores. Hence, again internal consistncy was reexamined for the remaining 46 items after removing these nine items. Results showed that α_{46}=0.88 and the items are significantly correlated to their total score. As the high alpha value of the 46 item version of the scale indicates the high internal consistency, the scale can be used to measure the pro environmental attitude. However, the 10 items that are highly correlated with their total scores exhibits an alpha of 0.85 and thus can be used as the shorter version of the original scale. Furthermore, for more generalizable results it is suggested to use probability sampling techniques with incresed sample size.

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APPENDIX

1. PRO ENVIRONMENTAL ATTITUDE QUESTIONNAIRE

Serial no.	Dimensions	Statement
1	CLE	I think spending time in maintaining a clean household is boring.
2	SEI	Nature is important because of what it can contribute to the pleasure and welfare of humans.
3	SR	I do not believe protecting the environment is an important issue.
4	SS	It is possible to improve quality of care if Governmental guidelines are provided.
5	RED	It is better to use roof, balcony and windows for gardening.
6	REC	Industry should be required to use recycled materials even when this costs more than making the same products from new raw materials.
7	REU	I am enthusiastic to use old goods provided by others.
8	CON	Conservation lowers peoples' standard of living.
9	SEI	Saving one plant instead of cutting reduces global warning.
10	SR	I prefer to change the things if it adversely affects the environment.
11	PC	Humans will eventually learn enough about how nature works to be able to control it.
12	RED	The balance of nature is very delicate and easily upset.
13	REC	Recycling is hectic and inconvenient.
14	REU	Reuse preserves resources.
15	CON	We should conserve environment even if peoples' welfare suffers.
16	CLE	Loss of goods occurs due to regular dusting.
17	SEI	Participating in decision making process helps one to be aware of the environment.
18	SR	I prefer sticking to a plan that works according to my needs.
19	CON	Regular environment awareness programs can help conserve the natural environment.
20	RED	The so-called "ecological crisis" facing humankind has been greatly exaggerated.

21	REC	Recycling prevents buying new materials and protects environment.
22	REU	Reuse helps protect environment.
23	CON	Loss of rainforests restricts development of new medicines.
24	CON	The balance of nature is strong enough to cope with the manmade changes in the environment.
25	SEI	I prefer using dustbins instead of littering on the street.
26	SR	As soon as I see an environmental problem, I start looking for a possible solution.
27	SS	I prefer to use separate waste bins for recyclable and non-recyclable products.
28	RED	When humans interfere with nature it often produces disastrous consequences.
29	REC	Recycling plastics help the environment.
30	REU	I prefer materials that can be reused.
31	CON	Environment should be protected for wellbeing of plants and animals rather than humans.
32	CLE	Maintaining cleanliness is time consuming.
33	SEI	I am not bothered by deforestation.
34	SR	I have a hard time setting goals relating to environment.
35	SS	Authority provides little fund to conserve the environment.
36	SS	Different sections in the institution should provide different waste bins.
37	REC	Humans have the right to modify the natural environment to suit their needs.
38	REU	I am willing to change my lifestyle to reduce environmental damage.
39	CON	I am not bothered to save water.
40	CLE	Dusting increases productivity.
41	SEI	I think compassion towards animals is necessary.
42	SS	People should carry out Government's recommendation to control global warming.
43	SR	Plants are taken care of in this institution.
44	RED	Segregation of waste materials is inconvenient.
45	REC	Recycling a product reduces its productivity and quality.
46	REU	I prefer not using plastics even if there are no alternatives.
47	CON	I intend to save natural resources whenever possible.
48	RED	The Earth has plenty of natural resources if we just learn how to develop them.
49	SEI	I think using solar energy is inconvenient.

50	SR	I am willing to consider other ways of making the environment better.
51	SS	Plants and animals have as much right as humans to exist.
52	CLE	Humans are seriously abusing the cleanliness of the environment.
53	REC	It disgusts me to see recyclable things thrown away.
54	REU	I think using bottles to plant trees help environment.
55	CON	I try to find ways to conserve power in daily life.

2. INFORMED CONSENT

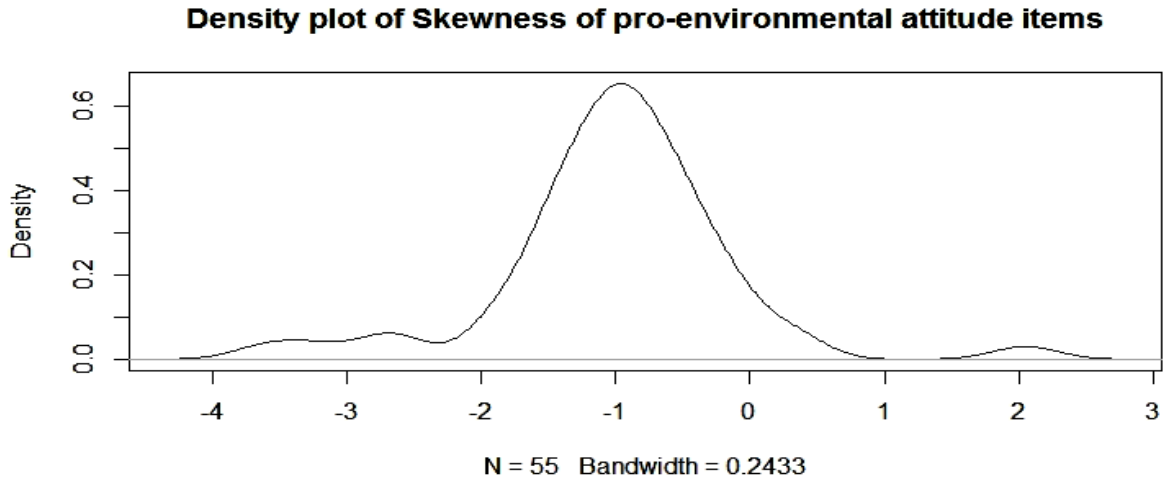
This study involves a web-based experiment designed to understand people's attitude towards the environment. The study is being conducted as a part of the internship programme ran by Indian Statistical Institute (Psychology Research Unit), Kolkata. Participation in the study typically takes 10-15 minutes and is strictly anonymous. Participation is voluntary, refusal to take part in the study involves no penalty and participants may withdraw from the study at any time without penalty or loss of benefits to which they are otherwise entitled.

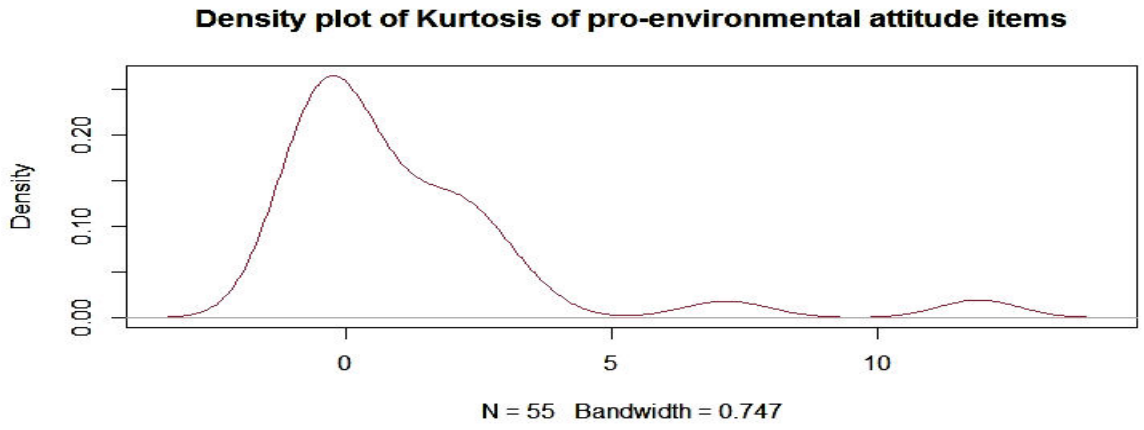
I hereby, give my voluntary consent, without any conflict of interest and without any coercion; with the understanding that this consent is for collection of data, only for purposes of research, and full confidentiality shall be maintained by the researchers about the disclosed information in this form. I hereby, give these informations as per my knowledge, in full disclosure, and in the spirit of advancement of scientific research.

3. SKEWNESS AND KURTOSIS

Name of items	**Skewness (N=129)**	**Kurtosis (N=129)**
A	-0.99	-0.26
B	2.05	3.30
C	-3.60	11.85
D	-1.30	1.77
E	-0.64	0.08
F	-0.93	0.46
G	-0.55	-0.71
H	-1.06	0.24
I	-1.85	2.77
J	-1.44	2.24
K	-0.90	-0.16
L	0.33	-0.71
M	-1.04	0.59
N	-1.03	1.22
O	-0.07	-0.60
P	-0.38	-0.86
Q	-0.95	1.19
R	0.29	-0.79
S	-1.37	1.83
T	-0.62	-0.79
U	-1.51	2.40
V	-1.05	0.66
W	-0.54	-0.27
X	-0.23	-1.06
Y	-3.23	11.93
Z	-0.77	0.42
A1	-1.09	0.11
B1	-1.58	1.89
C1	-1.45	1.67
D1	-1.00	-0.02
E1	-0.18	-1.18
F1	-0.52	-1.10
G1	-1.81	2.65

H1	-0.15	-0.74
I1	-0.77	0.30
J1	-0.96	0.10
K1	-0.83	-0.44
L1	-1.35	2.68
M1	-2.70	6.83
N1	-0.17	-0.64
O1	-1.52	2.41
P1	-0.82	-0.44
Q1	-0.79	0.00
R1	-0.54	-0.68
S1	-0.69	-0.55
T1	-0.56	-0.44
U1	-1.46	2.08
V1	-1.29	0.75
W1	-1.03	0.00
X1	-1.14	0.71
Y1	-2.64	7.44
Z1	-1.94	3.51
A2	-1.29	1.56
B2	-0.47	-0.54
C2	-1.19	2.15


Density plot of Skewness of pro-environmental attitude items
Density
0.0
0.2
0.4
0.6
-4
-3
-2
-1
0
1
2
3
N = 55 Bandwidth = 0.2433


Density plot of Kurtosis of pro-environmental attitude items
Density
0.00
0.10
0.20
0
5
10
N = 55 Bandwidth = 0.747

4. R SCRIPTS

```
n=read.table(file="clipboard",header=T,sep="\t")

n

nrmean=apply(n,1,mean)

boxplot(nrmean)

locator(3)

nrmean<2.88

n1=n[c(-16,-36,-91),]

n1

describe(n)

dim(n1)

n1rsum= apply(n1,1,sum)

newdata<-data.frame(n1,nsum)

newdata

cor.test(newdata$A,newdata$nsum)

cor.test(newdata$B,newdata$nsum)

cor.test(newdata$C,newdata$nsum)
```

```
cor.test(newdata$D,newdata$nsum)

cor.test(newdata$E,newdata$nsum)

cor.test(newdata$F,newdata$nsum)

cor.test(newdata$G,newdata$nsum)

cor.test(newdata$H,newdata$nsum)

cor.test(newdata$I,newdata$nsum)

cor.test(newdata$J,newdata$nsum)

cor.test(newdata$K,newdata$nsum)

cor.test(newdata$L,newdata$nsum)

cor.test(newdata$M,newdata$nsum)

cor.test(newdata$N,newdata$nsum)

cor.test(newdata$O,newdata$nsum)

cor.test(newdata$P,newdata$nsum)

cor.test(newdata$Q,newdata$nsum)

cor.test(newdata$R,newdata$nsum)

cor.test(newdata$S,newdata$nsum)

cor.test(newdata$T,newdata$nsum)
```

```
cor.test(newdata$U,newdata$nsum)

cor.test(newdata$V,newdata$nsum)

cor.test(newdata$W,newdata$nsum)

cor.test(newdata$X,newdata$nsum)

cor.test(newdata$Y,newdata$nsum)

cor.test(newdata$Z,newdata$nsum)

cor.test(newdata$A1,newdata$nsum)

cor.test(newdata$B1,newdata$nsum)

cor.test(newdata$C1,newdata$nsum)

cor.test(newdata$D1,newdata$nsum)

cor.test(newdata$E1,newdata$nsum)

cor.test(newdata$F1,newdata$nsum)

cor.test(newdata$G1,newdata$nsum)

cor.test(newdata$H1,newdata$nsum)

cor.test(newdata$I1,newdata$nsum)

cor.test(newdata$J1,newdata$nsum)

cor.test(newdata$K1,newdata$nsum)
```

```
cor.test(newdata$L1,newdata$nsum)

cor.test(newdata$M1,newdata$nsum)

cor.test(newdata$N1,newdata$nsum)

cor.test(newdata$O1,newdata$nsum)

cor.test(newdata$P1,newdata$nsum)

cor.test(newdata$Q1,newdata$nsum)

cor.test(newdata$R1,newdata$nsum)

cor.test(newdata$S1,newdata$nsum)

cor.test(newdata$T1,newdata$nsum)

cor.test(newdata$U1,newdata$nsum)

cor.test(newdata$V1,newdata$nsum)

cor.test(newdata$W1,newdata$nsum)

cor.test(newdata$X1,newdata$nsum)

cor.test(newdata$Y1,newdata$nsum)

cor.test(newdata$Z1,newdata$nsum)

cor.test(newdata$A2,newdata$nsum)

cor.test(newdata$B2,newdata$nsum)
```

```
cor.test(newdata$C2,newdata$nsum)

redata=read.table(file="clipboard",header=T,sep="\t")

redata

library(psych)

alpha(redata)

newitem=data.frame(redata$L1,redata$U1,redata$C2,redata$D1,redata$Y,redat
a$O1,redata$M,redata$R1,redata$Y1,redata$V)

dim(newitem)

alpha(newitem)
```