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Designing a test battery for the pre-assessment of aviation security screeners

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Abstract

Objectives of this study were to create a test battery as pre-assessment tool for airport screeners that is internally consistent (reliable) and able to predict detection performance later on the job (valid). The test battery consisted of a self-developed Noiser and Matrices test and a revised version of the object recognition test (ORT), originally developed by the Swiss company CASRA. The ORT is meant to measure image-based factors. The same applies for the Noiser test. The Matrices test was supposed to measure logical reasoning. To test the ability to predict detection performance, results of these tests had to predict the results of the X-Ray CAT 2. The X-Ray CAT2 was conducted after a period of trainings with the training software X-Ray TUTOR 3 (XRT3). The better the detection performances of the participants within the test battery was, the better should have been the performance within the X-Ray CAT 2. Results showed that the Matrices test had to be excluded due to a lack of reliability in its results. Despite the high reliability of the Noiser test, it was not found to validly predict future detection performance. Contrarily, the new version of the ORT predicted future detection performance well. Even a version with a significantly reduced number of items was reliable and valid, which is a precondition to create a test battery that is still economic from a timely point of view.

Key words: airport screeners, pre-assessment, image-based factors, object recognition test

Designing a test battery for the
pre-assessment of aviation security screeners

Even so September 11th 2001 is the most commonly known, it is one in a row of terrorist attacks in connection with aviation. Along with growing numbers of passengers carried each year, the need for security has extensively been growing - not only since 9/11 2001. This fact led to new, stricter rules and increased research in the field of aviation security, leading to new technological innovations. A good example for extensive changes in regulations for security reasons can be found looking at the numerous items that passengers aren`t allowed to bring with them into the cabin of the plane: certain amounts of liquids, knifes or fire weapons for example.

For checking hand luggage, x-ray screening is used, which is done by aviation security screeners. With growing numbers of passengers, the job tasks of the screeners are becoming more and more demanding. The screening task includes specific knowledge of prohibited items and how they look like in x-ray images of passenger bags. To gain this knowledge, Screeners have to attend trainings on a regular basis after being employed. Knowing the prohibited items is essential to be able to recognize them. Graf, Schwaninger, Wallraven & Bülthoff showed that to recognize an item, a stimulus has to match a visual memory representation that was stored earlier. If a presented prohibited item has never been seen before it will not be recognized. During the training, screeners get to know a wide variety of items, which are presented as X-ray images. Improvements in the detection abilities after attending the trainings on a regular basis are proven (Koller, Hardmeier, Michel, & Schwaninger, 2007).

Next to this knowledge-based factors described above image-based factors are also needed to be successful. Schwaninger (2005) defined three image-based factors that have a major impact on detection: bag complexity, superposition and viewpoint. Schwaninger, Hardmeier, &

Hofer (2005) pointed out that image-based factors affect detection performance independent from knowledge by testing professional screeners and novices. Both groups were tested using the object recognition test (ORT), which is primarily related to visual processing and encoding (image-based factors), and the prohibited item test (PIT), which was designed to measure acquired knowledge of prohibited items (knowledge-based factors). For this purpose the PIT presents a wide range of prohibited items like guns, sharp objects, inflammable materials but also other prohibited items like ivory or crocodile. Knowledge of the shape and forms of the prohibited items is essential. To eliminate this knowledge factor and focus on image-based factors within the ORT, only knives and guns are used as the form of these objects are commonly known. However, these objects are presented in complex bag environments and bag complexity, superposition and viewpoint vary systematically. As expected due to the knowledge factor Screeners performed better than novices. Nevertheless, results showed that, independent from proficiency (screeners vs. novices), detection performance was significantly affected when prohibited (treat)items were rotated, superimposed or presented in complex bag environments. The results, as well as the fact that additional large individual differences in detection performance were observed for both groups, indicate that image-based factors are rather related to relatively stable abilities than mere knowledge gained through trainings.

Due to the fact that trainings are mandatory for every screener, it should be useful to test the ability to deal with image-based factors before the persons are employed. This would help to identify candidates that are more likely to be successful later on the job. The ORT (see above) was developed as a pre-assessment tool by Hardmeier, Hofer & Schwaninger (2005). The authors found evidence that the detection performance of employed screeners who used the ORT

was significantly better than the performance of screeners who did not. Additional reliability and validity are well proven.

Daniela Hardmeier (2008) noted a possibility to measure image-based factors by using general visual cognition tests, as they are related to general visual cognition processes like visual search, figure ground segregation or mental rotation. Additionally, tests that measure general logical thinking should be useful because of the wide variety of shapes of improvised explosive devices (IEDs), which have to be detected by screeners as well. As there is no common form or shape of these devices, screeners have to focus on components like power source, detonator or explosive materials. Logical reasoning may help in these cases, as recalling already stored visual information is not possible. Considering that fact brings us to a disadvantage of the ORT, which is presenting knives and guns only because other prohibited items are generally not known to the candidates before they attend the first training. In contrast the shape of knives and guns are well known. Therefore, it is unlikely that the ORT will provide any information on the applicants' abilities in regard to logical reasoning. To include additional tests measuring general visual and most of all cognitive abilities would be useful and add value to a valid and reliable recruitment process of screeners.

Hardmeier created a cognitive test battery (CTB) by putting together 12 different tests from elaborated German intelligence test batteries. The included tests shewere for example Raven`s Advanced Progressive Matrices (Raven, Court, & Raven Jr, 1980), the subtest LPS10 of the Leistungsprüfsystem by Horn (1983), the Noiser which was developed by the University of Zurich (Marxer, 2004) or the Letter Search Test (LST) by Marxer (2004). For a complete overview please refer to Hardmeier (2008). Additionally the ORT was conducted as well. A Confirmatory Factor Analysis indicated that all 12 test factors loaded on the one factor denoted

as “ability of screeners”. Performing a full structural equation model analysis (SEM) with the main explanatory latent variable “ability of screeners”, the author showed that this latent variable correlated highly with detection performance in X-ray screening measured through the PIT (see above) and the bomb detection test (BDT) suggesting that this cognitive test battery seems to be an important predictor for screening performance later on the job. Additionally, the reduction of the CTB to four tests without losing any explained variance was suggested by Hardmeier.

Given the hypothesis that image-based factors, which are measured by the ORT, can just as well be measured with general visual-cognitive tests, the results were surprising that next to the CTB the ORT still had a significant effect on detection performance. Even though the CBT and the ORT were highly correlated, the results suggested that both tools are needed to determine screening performance.

Based on that the current study wants to further develop the idea of a pre-assessment tool for screeners that includes general visual and cognitive test elements to valid predict future detection performances.

Next to psychometric aspects like reliability and validity, another fundamental requirement to a useful pre-assessment tool is test economy i.e. the time efficiency of the assessment. Even after following Hardmeier`s suggestion to shorten the test battery from 12 to 4 tests, the test would still take too much time to be conducted next to the ORT. Thus only 2 additional tests were selected: the Noiser and Matrices test. The Matrices test was chosen to test logical reasoning, assuming that this factor may have a significant influence on detection performance especially in regard to IEDs. The Noiser test measuring figure-ground segregation was chosen to test general visual abilities. Additionally, similar to the future job task within the

Noiser objects have to be recognized in front of a high complex background. Thus, the test is to be perceived to have high face validity.

The main goal of this study was to create a test battery consisting of a Noiser and Matrices test and to evaluate a revised version of the ORT with respect to its reliability and its ability to predict detection performance. Therefore, it was expected that the performance in the test battery was able to predict subsequently shown detection performance (predictive validity).

Furthermore, the individual tests were analyzed with respect to explained variance and condensed as much as possible without losing reliability and explained variance.

Method

Participants

The sample consisted of 39 participants *(M = 30,5, SD = 10,34, age range between 17 and 62 years)*. The sample was recruited from two different sources. The first group of participants consisted of 9 students of applied psychology, who attended a module in research methods and experimental design. Each of the students recruited additional participants. The second group consisted of 9 persons, who were recruited by the researcher. Overall, 18 female and 21 male persons participated. 13 participants (6 male, 7 female) with an age between 23 and 35 (*M = 28,2; SD = 7,80)* were assigned to the control group, i.e. conducted the tests without training. 18 participants were assigned to the experimental group and they conducted all tests and trainings. The remaining 8 persons did not conduct all tests completely and were used in reliability analysis only.

One participant of the experimental group had to be excluded from the analysis due to the fact that this person`s results in the Noiser test were a significant outlier. The exclusion criterion will be explained in detail later on. Thus, the experimental group included in the analysis

consisted of 9 female and 8 male participants with an age ranging between 23 and 39 years (*M = 29,1,SD = 4,22)*

Procedure and tests

All tests were conducted online. Participants received a time schedule when tests and trainings had to be done and login data was provided to do all sessions at home. The test battery consisted of the ORT, Matrices and Noiser test. After having conducted the test battery, participants had to join training sessions that were framed by the X-ray competency assessment test (X-ray CAT). Training sessions were done using the X-Ray TUTOR 3 (XRT3).

To minimize effects of order, the sequence of the tests was systematically varied within the test battery for all participants. After conducting the ORT, half of the participants had to conduct the Matrices first and then the Noiser, and half of them had to conduct the Noiser before the Matrices test.

The participants of the control group conducted only the test battery and X-ray Cat tests without any training.

Test battery

Object Recognition Test (ORT). As mentioned above, the original object recognition test (ORT) was developed by Hardmeier, Hofer & Schwaninger (2005) as a pre-assessment tool for screeners. It consists of 256 x-ray images that are presented in black and white. Only guns and knives are presented to assure independence from visual experience and knowledge (these shapes are well known to novices as well). The image based factors superposition, bag complexity and viewpoint are varied systematically. The same bag is presented once with and once without a prohibited item. Reliability and validity of the ORT are well proven.

For the current study, a newly developed version of the ORT was used and evaluated with respect to its reliability and validity. The main difference between the former and the revised version is that all bags are presented in color to increase its external validity. Overall, 384 bags were presented, of which 256 bags contained a prohibited item and 128 bags did not. Still, only knives (8) and guns (8) were used and presented in 2 different rotations (easy vs. difficult), complexities (low vs. high) and super positions (low vs. high). Each prohibited item was presented two times to check the influence of different bags, leading to 256 bags, in which a threat item was included (8x2x2x2x2x2= 256). For the bags that did not contain a prohibited item the complexity was varied systematically (2x64=128).

Before the test was started, all included prohibited items were presented for 10s to the participants. Thereafter, each bag was shown for 4s. The participants had to decide whether the bag contained a prohibited item (not ok) or not (ok). No feedback on the correctness of the answer was given during the experiment.

Matrices. The Matrices test was created based on Raven`s Advanced Progressive Matrices test (Raven et al, 1980) which is mainly used for measuring logical reasoning. A matrix of 3*3 abstract figures has to be completed as the picture in the lower right corner is missing. Eight alternatives are given as a possible answer whereas just one is correct. Half of the matrices are presented in black and white and the other half in color. An online version of the test was implemented using the casra learning system (CLS), an online learning tool which can also be used for test creation and implementation. After the test had been started 2 test trials were presented where the user could ask for feedback on their decision. Subsequently, 10 different matrices had to be solved within 20 minutes without any feedback.

Noiser. As mentioned earlier, the Noiser tests figure-ground segregation. The task consists of triangles which have to be recognized in front of a highly complex background. The triangles are presented in two different sizes (100 vs. 200 mm side - length). The complex background consists of lines that are presented in 4 different colors (green, red, yellow and blue) and 4 different line lengths. Additionally, the number of lines varies. A pretest was conducted with a sample of 93 airport screeners who were asked to solve a set of 64 items. The results showed that the position of the triangle did not have an effect on detection performance. Additionally, the reliability of the test was found to be high. However, the test items seemed to be rather too easy as the scores revealed a pronounced ceiling effect.

Based on these results the 32 Items that were most difficult were selected from the pool. Furthermore, to simulate and approximate a realistic screening situation, these 32 items were presented two times – once with and once without a triangle. Therefore, participants either had to click on a triangle or on the sign “no triangle”. Thus, the applied test consisted of 64 items that participants had to solve within 35 minutes. Again, the CASRA learning system (CLS) was used for the online setup of the test and no feedback was given on the answers.

Training and Training-Tests

X-ray competency assessment test (X-ray CAT). The X-ray CAT is part of XRT3 and tests whether the detection performance has been improved by training with the XRT3. To measure the improvement, the X-ray CAT has to be conducted before (X-ray CAT 1) and after (X-ray CAT 2) an interval of training sessions. The X-ray CAT consists of 128 x-ray images of bags, of which half contain the prohibited items of the already mentioned 4 categories (guns, knives, IEDs and others). Each bag is presented two times – once with and once without a prohibited item. The position of and the view on the items and the bag complexity are kept

parallel. Participants are required to respond within 10 seconds whether a bag contains a prohibited item (not ok) or not (ok). The look and feel of the user interface is the same as in the trainings with the exception that no feedback is given during the test situation.

X-Ray TUTOR 3 (XRT3). To test the ability of the test battery to predict future detection performance, participants had to conduct the X-ray CAT. In contrast to the ORT, items were presented in the X-ray CAT, which may have been unknown to novices. Therefore, trainings had to be conducted over a 5 weeks period using the X-Ray TUTOR 3 (XRT3). Overall participants conducted training sessions between 1.01 and 9.65 hours (M = 3.93h).

The online training tool was developed by the Swiss company CASRA. In the XRT3, participants are trained to detect prohibited items (threat items) by presenting x-ray images of bags which occasionally contain these items. The prohibited items belong to one of the four different categories guns, knives, improvised explosive devices (IEDs) and others, like stun guns, brass knuckles or fireworks. The training implements different difficulty levels. The images of the bags are presented for 30s. Users have to decide whether a prohibited item is present (not ok) or not (ok) and click on the threat item if included in the bag. Immediately thereafter, a direct feedback is provided and users can request detailed information on the presented items by opening up an additional window. The effectiveness of the XRT3 to improve detection performance is well documented. Schwaninger & Wales (2009) showed that the detection performance of airport screeners using the XRT3 was significantly enhanced after one year and reaction time dropped.

Results

Variables

To measure the dependent variable "detection performance of the X-Ray CAT 2" A' was used. A' is a "nonparametric" detection performance measure that takes into account the hit rate (identifying prohibited items) as well as the false-alarm rate (mistakenly identifying bags as not ok). To consider the false alarm rate is important because a participant could achieve a 100% percent hit rate by simply declaring all bags as not ok. For further information on A' please refer to Stanislaw and Todorov (1999) or MacMillan and Creelman (1991). For the dependent variables "Noiser-scores" and "Matrices-scores", the percentage of correctly solved items was used. To measure the detection performance of the ORT, again, A' was calculated.

Manipulation check

To verify the effectiveness of the trainings *t* tests were calculated by comparing detection performance averages of the tests before (X-Ray CAT 1) and after (X-Ray CAT 2) the training sessions and between the two groups (training vs. control). Both analysis showed a significant difference in the mean of detection performances between the tests ($t(16) = -4.493$, $p = .001$) and between the groups ($t(29 = 4.202$, $p < .001$) suggesting that training sessions led to significantly better detection performances. Participants who conducted trainings were better in the X-Ray CAT 2 ($M = 0.7347$) than in the test before the trainings ($M = 6.433$) and they were also better in detecting prohibited items after the trainings compared with the control group that did not conduct any trainings ($M = 0.6354$).

A *t* test comparing the results of the control group in the X-Ray CAT 1 ($M = 0.6392$) and 2 ($M = 0.6354$) did not show a significant difference ($t(12) = .285$, $p > .75$). Therefore, the group

that did not have any training did not improve in detection performance indicating the efficiency of the training conducted with the XRT3.

Reliability

Cronbach's alpha was calculated for all tests (ORT, Noiser test and Matrices test) to verify internal consistency. For an overview please refer to table 1 in the attachment.

Unfortunately Cronbach's alpha of the Matrices test (0.67) did not meet the suggested level for good reliability. For information on requirements to reliability levels please refer to Bortz (2004). Therefore, the test was excluded from any of the following analyses.

A Cronbach's alpha of .864 for the ORT and .919 for the Noiser indicated that both test measured detection performance reliable.

Predictive Validity

To evaluate if the test battery, which consisted of the ORT and Noiser test after excluding the Matrices test was still able to predict detection performances, the results of these tests were treated as independent variables to predict the results of the X-Ray CAT 2. Thus, the better the detection performances of the participants within the test battery was, the better should be the performance within the X-Ray CAT 2, which was conducted after the training sessions.

To test this hypothesis a linear regression was calculated using A' of the ORT and the percentage of solved items within the Noiser as independent variables and A' of the X-Ray CAT 2 as the dependent variable.

Due to the fact that the sample included less than 30 persons, all requirements to the data were assessed. The residuals were following a normal distribution and homoscedasticity was indicated. Furthermore, absence of autocorrelation (Durbon-Watson coefficient of 1,903) and multicollinearity (*tolerance = .937*; *VIF = 1.068*) was indicated. Additionally, the linear

relationship of the variables was checked and the data was screened for significant outliers. One significant outlier was identified. The result of one participant in the Noiser (*47,06*) differed more than 2 standard deviations (*SD = 12.94*) from the average result (*M = 74.59*). As a consequence, this participant was excluded from the analysis. The data was found to satisfy all requirements needed to apply linear regression. For more information on the requirements to linear regression and related tests please refer to Bortz (2004) and Urban and Mayerl (2008).

Means, standard deviations and inter correlations for the variables are displayed in Table 2.

Table 3 shows the regression results. The ORT was significantly positively related to the CAT2 results ($\beta = .772$, $p < .001$). According to that result, the ORT is a valid predictor of future detection performance. However, no significant positive relation could be found for the Noiser test ($\beta = .12$, $p = .947$). Therefore the ability of the Noiser test to predict detection performance was not indicated by this experiment.

Table 3: Results of Linear Regression Analysis

Linear Regression	β	R^2	R^2adjusted	*dfs*
Dependent variable: CAT2				
		.601	.544	.04114
ORT	.772**			
Noiser	.012			

Note. Total $F(2, 14) = 10.543$, $p < .005$.
**$p < .001$.

Due to the non-significant result of the Noiser in the previous analysis, a second linear regression was calculated without the Noiser test, which led to a slight increase of adjusted R^2 ($\Delta R^2 = 0.03$) and an increase of significance of the model (see table 4).

Table 4: Results of Linear Regression Analysis without Noiser full item set

Linear Regression	β	R^2	R^2adjusted	*dfs*
Dependent variable: CAT2				
		.601	.574	.03975
ORT	.775**			

Note. Total $F(1, 15) = 22.579$, $p < .001$.
**$p < .001$.

Enhancing efficiency of the ORT by reducing the number of items

A basic requirement to a useful pre-assessment tool is test economy - more specifically the time that participants have to spend for being tested. As already mentioned in the current study, a revised version of the ORT was used. In this revised version, 384 bags were presented, whereof 256 bags contained a prohibited item and 128 bags did not. 8 different kinds of knives and guns were used and presented in 2 different rotations (views), complexities (low vs. high) and super positions; furthermore, each of these prohibited items was presented twice (8x8x2x2=256). Bags that did not contain a prohibited item were systematically varied with respect to complexity (2x64=128).

As all prohibited items were presented two times, this number was halved in a next step to better comply with test economy. The decision on which of the two prohibited items was to be excluded was done based on quality characteristics of the single items. According to Moosbrugger & Kelava (2007) two major criteria for item selection are item discrimination, which is the correlation of an individual item with the overall scale, and item difficulty, which gives the proportion of correct responses and therefore the item`s variance. Emphasis was laid on item discrimination. If there was no difference in item discrimination, the item with a medium

difficulty was selected. For detailed information on the individual items and the selection of the items please refer to appendix 1.

After excluding half of the items with prohibited objects, the whole set was tested for reliability and, again, a linear regression was calculated. Reliability-analysis showed an increase of Cronbach's alpha to .881 (see table 5). Again the results of the linear regression showed the ORT was significantly positively related to the CAT2 results ($\beta = .693$, $p < .005$), but the reduction of the items led to an decrease in explained variance. For details, refer to table 6:

Table 6: Results of Linear Regression Analysis without Noiser, reduction step 1

Linear Regression	B	R^2	R^2adjusted	*dfs*
Dependent variable: CAT2				
		.480	.446	.04536
ORT	.693**			

Note. Total $F(1, 15) = 13.857$, $p < .005$.
**$p < .005$.

Finally, the number of items of the ORT was further reduced by excluding half of the threat-items (4 guns and 4 knives). Again, item discrimination and item difficulty were used as exclusion criteria for four of the guns and four of the knives. For detailed information please refer to appendix 2. Additionally, the number of items (bags) without prohibited items was reduced from 128 to 64. The 32 high-complex and 32 low-complex bags that were lowest on item-scale-correlation were excluded.

Again, a reliability-analysis showed an increase of Cronbach's alpha to .890 (see Table 5) and a linear regression showed that the reduction of the items led to an further decrease in explained variance. Still the model was highly significant and even this massive reduced version of the ORT was still significantly positively related to the CAT2 results ($\beta = .$, $p < .005$) For details refer to the table 7:

Table 7: Results of Linear Regression Analysis without Noiser, reduction step 2

Linear Regression	*β*	R^2	R^2adjusted	*dfs*
Dependent variable: CAT2				
		.449	.412	.04670
ORT	.670**			

Note. Total $F(1, 15) = 12.224$, $p < .005$.
**$p < .005$.

Discussion

Objectives of this study were to create a test battery as an assessment tool for airport screener applicants that is internally consistent (reliable) and able to predict detection performance later on the job. The test battery consisted of a Noiser and Matrices test and a revised version of the ORT. To test the ability of the test battery to predict detection performance, results of these tests were required to predict the results of the X-Ray CAT 2 – a test that was conducted after a period of trainings. The better the detection performances of the participants within the test battery was the better the performance within the X-Ray CAT 2 was expected. Finally, the tests were shortened without losing their predictive validity (explained variances) to make them as economic as possible.

Unfortunately, reliability of the Matrices test was not sufficient, leading to exclusion of the Matrices test from all following analyses. Especially the Matrices test was supposed to add predictive power as this test measures general logical reasoning. Logical reasoning was suggested to help in situations where the recall of already stored visual information is not possible. These situations occur because some prohibited items have a wide variety of shapes like improvised explosive devices (IEDs). The main reason for the low reliability may be found in the small number of included items.

For the Noiser test and the new version of the ORT, good reliability estimates were obtained. Despite its good reliability this Noiser test was not found to be able to predict detection performance. It seems that only measuring figure ground segregation abilities is not sufficient to predict the ability to deal with image-based factors which is needed to achieve a good detection performance. Furthermore there are certain limitations to the Noiser test that may have had an major impact. This limitations will be explained later on.

The revised ORT was found to predict detection performance well, which is in line with past findings on the original ORT by Hardmeier, Hofer & Schwaninger (2005). This revised version of the ORT with its 364 items takes a lot of time for participants to conduct. To secure test economy, the number of items was reduced in two steps. Both reduction steps led to an increase of reliability but as well to a decrease of adjusted R^2. Still, the ability of both the reduced versions of the ORT to validly predict future detection performance could be verified. This opens up the possibility to establish different versions of the ORT depending on different recruitment processes. Using the ORT as the only tool to pre-assess screeners, the full version should be used as it is the most valid of all three versions. By adding other tests or other recruitment-tools like assessment centers to the recruitment process a shorter version f the ORT should be used. The shortest version for example with 128 items should not take longer than 20 minutes. Still this version was found to predict future detection performance well while delivering excellent test economy. This opens up the possibility to add supplemental tests without overstraining the participants. Thus, the revised ORT helps to improve the efficiency and effectiveness in the recruitment process of airport screeners.

There were two main limitations within the experimental process that may have had an significant impact. First, the online system, which was used for creating and implementing the

Matrices and Noiser test (CLS), had notable limitations. The major disadvantage was the fact that participants were allowed to change already made decisions by going back to that respective question. Although they were asked not to do so, it was not possible to prevent them from going back if they wanted to. This procedure may have had an impact on the participants' decisions and therefore on the overall reliability. Another important influence was supposedly the small number of participants. Due to the fact that the whole experimental design was complex and time consuming for the participants, it was difficult to find numerous volunteers to join the research. For future research, it may help to use settings where airport screeners are hired in large numbers and use these groups for conducting research as they have to do trainings anyway.

Unfortunately by excluding the Matrices test it was not possible anymore to investigate the possibility to predict detection performance by measuring general logical reasoning. Hardmeier (2008) showed that that logical thinking next to image based factors seems to be an important determinant for screening performance later on the job Thus, based on this research an ongoing research and development in that kind of tests is highly recommended. Raven`s Advanced Progressive Matrices (Raven et al, 1980) is a well validated test for measuring logical reasoning. Therefore developing a test similar to that with enough items would be useful to confirm the findings of Hardmeier. To create a new set of matrices, it is suggested to test that new items in combination with Raven`s Advanced Progressive Matrices test to ensure the validity of the newly developed test. Adding such tests to the ORT should enhance the quality of the recruitment of airport screeners by providing more information regarding the future detection performance of the applicants.

To summarize the objective to create a test battery that includes general visual and cognitive test elements was not achieved. Nevertheless the results encourage to shorten the new

version of the ORT to create a test that predicts future detection performance well while delivering excellent test economy. This short version of the ORT is the basis for adding more tests that deliver more information and add value to a valid and reliable recruitment process of airport screeners.

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Tables

Table 1: Reliability Analysis ORT, Noiser and Matrices

	Cronbach Alpha
ORT	.864
Noiser	.919
Matrices	.67

Table 2: Means, SDs and auto correlations

	M	*SD*	1	2
1 CAT 2	0.7312	0.06092		
2 ORT	0.8835	0.04107	.775**	
3 Noiser	76.21	1129897	.206	.252

Note. $N = 17$. ** Correlation significant at $p < .001$

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		.601	.574	.03975
ORT	.775**			

Note. Total $F(1, 15) = 22.579$, $p < .001$.
**$p < .001$

Table 5: Reliability Analysis of the ORT with first and second reduction step

	ORT	ORT after 1st reduction	ORT after 2nd reduction
Cronbach`s alpha	.864	.881	.890

Table 6: Results of Linear Regression Analysis without Noiser, reduction step 1

Linear Regression	B	R^2	R^2adjusted	*df*s
Dependent variable: CAT2				
		.480	.446	.04536
ORT	.693**			

Note. Total $F(1, 15) = 13.857$, $p < .005$.
**$p < .005$.

Table 7: Results of Linear Regression Analysis without Noiser, reduction step 2

Linear Regression	β	R^2	R^2adjusted	*dfs*
Dependent variable: CAT2				
		.449	.412	.04670
ORT	.670**			

Note. Total $F(1, 15) = 12.224$, $p < .005$.
**$p < .005$.

Appendix

Appendix 1: List of ORT items with difficulties, Item Scale Correlation and deleted items

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	*Delete (1=yes)*
Gun 1	ORT3.0VT_SN_bch_suph_can_t0000721h000v000p000f0_bag114847.cmg	.74	.231	.442	39	0
	ORT3.0VT_SN_bch_suph_can_t0000721h000v000p000f0_bag161222.cmg	.33	.043	.478	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000721h085v000p000f0_bag154343.cmg	.59	.312	.498	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000721h085v000p000f0_bag184927.cmg	.31	-.006	.468	39	1
	ORT3.0VT_SN_bch_supl_can_t0000721h000v000p000f0_bag162803.cmg	.95	.068	.223	39	1
	ORT3.0VT_SN_bch_supl_can_t0000721h000v000p000f0_bag222358.cmg	.97	.234	.160	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000721h085v000p000f0_bag185540.cmg	.97	-.149	.160	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000721h085v000p000f0_bag193034.cmg	.97	.186	.160	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000721h000v000p000f0_bag115937.cmg	.95	.095	.223	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000721h000v000p000f0_bag145436.cmg	.77	.327	.427	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000721h085v000p000f0_bag102457.cmg	.38	.241	.493	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000721h085v000p000f0_bag151804.cmg	.72	.051	.456	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000721h000v000p000f0_bag092358.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000721h000v000p000f0_bag110138.cmg	.97	.119	.160	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000721h085v000p000f0_bag110600.cmg					0
	ORT3.0VT_SN_bcl_supl_rot_t0000721h085v000p000f0_bag113505.cmg	.97	-.120	.160	39	1
Gun 2	ORT3.0VT_SN_bch_suph_can_t0000725h000v000p000f0_bag043459.cmg	.72	.292	.456	39	0
	ORT3.0VT_SN_bch_suph_can_t0000725h000v000p000f0_bag113527.cmg	.56	.137	.502	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000725h000v085p000f0_bag064402.cmg	.69	.549	.468	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000725h000v085p000f0_bag111546.cmg	.51	.093	.506	39	1
	ORT3.0VT_SN_bch_supl_can_t0000725h000v000p000f0_bag052448.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000725h000v000p000f0_bag121039.cmg					0
	ORT3.0VT_SN_bch_supl_rot_t0000725h000v085p000f0_bag122942.cmg	.85	.245	.366	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000725h000v085p000f0_bag161234.cmg	.90	.094	.307	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000725h000v000p000f0_bag123824.cmg					1
	ORT3.0VT_SN_bcl_suph_can_t0000725h000v000p000f0_bag145106.cmg	.97	.186	.160	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000725h000v085p000f0_bag051801.cmg	.82	.333	.389	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000725h000v085p000f0_bag185939.cmg	.95	.143	.223	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000725h000v000p000f0_bag110808.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000725h000v000p000f0_bag143714.cmg					0
	ORT3.0VT_SN_bcl_supl_rot_t0000725h000v085p000f0_bag151842.cmg	.90	.471	.307	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000725h000v085p000f0_bag183730.cmg	.90	.345	.307	39	1

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Gun 3	ORT3.0VT_SN_bch_suph_can_t0000726h000v000p000f0_bag051208.cmg	.90	.385	.307	39	0
	ORT3.0VT_SN_bch_suph_can_t0000726h000v000p000f0_bag114513.cmg	.87	.380	.339	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000726h085v000p000f0_bag152559.cmg	.54	.162	.505	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000726h085v000p000f0_bag183935.cmg	.85	.177	.366	39	0
	ORT3.0VT_SN_bch_supl_can_t0000726h000v000p000f0_bag050744.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000726h000v000p000f0_bag193214.cmg	.95	.061	.223	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000726h085v000p000f0_bag062328.cmg	.90	.000	.307	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000726h085v000p000f0_bag114540.cmg	.95	.315	.223	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000726h000v000p000f0_bag073651.cmg	.77	.095	.427	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000726h000v000p000f0_bag103908.cmg					1
	ORT3.0VT_SN_bcl_suph_rot_t0000726h085v000p000f0_bag163857.cmg	.74	.182	.442	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000726h085v000p000f0_bag203941.cmg	.95	.205	.223	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000726h000v000p000f0_bag150937.cmg	.97	.042	.160	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000726h000v000p000f0_bag152808.cmg	.97	-.025	.160	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000726h085v000p000f0_bag155840.cmg	.87	.339	.339	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000726h085v000p000f0_bag163539.cmg	.92	-.009	.270	39	1
Gun 4	ORT3.0VT_SN_bch_suph_can_t0000904h000v000p000f0_bag064312.cmg	.13	-.028	.339	39	1
	ORT3.0VT_SN_bch_suph_can_t0000904h000v000p000f0_bag190321.cmg	.54	.156	.505	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000904h000v085p000f0_bag081818.cmg	.64	.217	.486	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000904h000v085p000f0_bag202224.cmg	.33	.243	.478	39	0
	ORT3.0VT_SN_bch_supl_can_t0000904h000v000p000f0_bag081337.cmg	.44	.103	.502	39	0
	ORT3.0VT_SN_bch_supl_can_t0000904h000v000p000f0_bag105325.cmg	.79	-.042	.409	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000904h000v085p000f0_bag110907.cmg	.51	.322	.506	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000904h000v085p000f0_bag112658.cmg	.54	.359	.505	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000904h000v000p000f0_bag042226.cmg	.31	.387	.468	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000904h000v000p000f0_bag052120.cmg	.49	.118	.506	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000904h000v085p000f0_bag115433.cmg	.38	.197	.493	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000904h000v085p000f0_bag193235.cmg	.28	-.121	.456	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000904h000v000p000f0_bag134829.cmg	.49	-.060	.506	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000904h000v000p000f0_bag165611.cmg	.69	.086	.468	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000904h000v085p000f0_bag145619.cmg	.85	.076	.366	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000904h000v085p000f0_bag181308.cmg	.67	.412	.478	39	0

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Gun 5	ORT3.0VT_SN_bch_suph_can_t0000650h000v000p000f0_bag083719.cmg	.85	.148	.366	39	0
	ORT3.0VT_SN_bch_suph_can_t0000650h000v000p000f0_bag124247.cmg	.87	-.056	.339	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000650h000v085p000f0_bag102031.cmg	.82	.019	.389	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000650h000v085p000f0_bag190753.cmg	.69	.298	.468	39	0
	ORT3.0VT_SN_bch_supl_can_t0000650h000v000p000f0_bag090227.cmg	.92	-.032	.270	39	1
	ORT3.0VT_SN_bch_supl_can_t0000650h000v000p000f0_bag111128.cmg	.97	-.025	.160	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000650h000v085p000f0_bag064642.cmg	.87	.111	.339	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000650h000v085p000f0_bag163131.cmg	.82	.221	.389	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000650h000v000p000f0_bag091814.cmg	.97	-.025	.160	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000650h000v000p000f0_bag171303.cmg	.85	.346	.366	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000650h000v085p000f0_bag103323.cmg	.69	.099	.468	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000650h000v085p000f0_bag153201.cmg	.72	.065	.456	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000650h000v000p000f0_bag111326.cmg	.90	.020	.307	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000650h000v000p000f0_bag183202.cmg	.92	.076	.270	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000650h000v085p000f0_bag161740.cmg	.95	.047	.223	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000650h000v085p000f0_bag194323.cmg	.92	-.111	.270	39	1
Gun 6	ORT3.0VT_SN_bch_suph_can_t0000780h000v000p000f0_bag111847.cmg	.72	.422	.456	39	0
	ORT3.0VT_SN_bch_suph_can_t0000780h000v000p000f0_bag133313.cmg					1
	ORT3.0VT_SN_bch_suph_rot_t0000780h085v000p000f0_bag073132.cmg					1
	ORT3.0VT_SN_bch_suph_rot_t0000780h085v000p000f0_bag201353.cmg	.69	.136	.468	39	0
	ORT3.0VT_SN_bch_supl_can_t0000780h000v000p000f0_bag061104.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000780h000v000p000f0_bag104955.cmg	.79	.506	.409	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000780h085v000p000f0_bag042040.cmg	.97	-.006	.160	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000780h085v000p000f0_bag191652.cmg	.97	.195	.160	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000780h000v000p000f0_bag111129.cmg	.90	.149	.307	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000780h000v000p000f0_bag154936.cmg					1
	ORT3.0VT_SN_bcl_suph_rot_t0000780h085v000p000f0_bag160040.cmg					1
	ORT3.0VT_SN_bcl_suph_rot_t0000780h085v000p000f0_bag193857.cmg	.87	.070	.339	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000780h000v000p000f0_bag075337.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000780h000v000p000f0_bag183956.cmg					0
	ORT3.0VT_SN_bcl_supl_rot_t0000780h085v000p000f0_bag115747.cmg					1
	ORT3.0VT_SN_bcl_supl_rot_t0000780h085v000p000f0_bag163223.cmg	.92	.367	.270	39	0

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Gun 7	ORT3.0VT_SN_bch_suph_can_t0000912h000v000p000f0_bag102920.cmg	.97	-.053	.160	39	0
	ORT3.0VT_SN_bch_suph_can_t0000912h000v000p000f0_bag204652.cmg					1
	ORT3.0VT_SN_bch_suph_rot_t0000912h085v000p000f0_bag070046.cmg	.77	.240	.427	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000912h085v000p000f0_bag100956.cmg	.82	.433	.389	39	0
	ORT3.0VT_SN_bch_supl_can_t0000912h000v000p000f0_bag110447.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000912h000v000p000f0_bag161725.cmg					0
	ORT3.0VT_SN_bch_supl_rot_t0000912h085v000p000f0_bag075411.cmg					1
	ORT3.0VT_SN_bch_supl_rot_t0000912h085v000p000f0_bag193227.cmg					0
	ORT3.0VT_SN_bcl_suph_can_t0000912h000v000p000f0_bag110446.cmg	.95	.047	.223	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000912h000v000p000f0_bag153704.cmg					1
	ORT3.0VT_SN_bcl_suph_rot_t0000912h085v000p000f0_bag161444.cmg	.95	-.124	.223	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000912h085v000p000f0_bag200353.cmg	.97	.186	.160	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000912h000v000p000f0_bag044526.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000912h000v000p000f0_bag080955.cmg	.97	.080	.160	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000912h085v000p000f0_bag091532.cmg					1
	ORT3.0VT_SN_bcl_supl_rot_t0000912h085v000p000f0_bag160818.cmg					0
Gun 8	ORT3.0VT_SN_bch_suph_can_t0001004h000v000p000f0_bag065840.cmg	.87	.284	.339	39	1
	ORT3.0VT_SN_bch_suph_can_t0001004h000v000p000f0_bag170826.cmg	.69	.060	.468	39	0
	ORT3.0VT_SN_bch_suph_rot_t0001004h000v085p000f0_bag112258.cmg	.28	-.260	.456	39	1
	ORT3.0VT_SN_bch_suph_rot_t0001004h000v085p000f0_bag192140.cmg	.38	.162	.493	39	0
	ORT3.0VT_SN_bch_supl_can_t0001004h000v000p000f0_bag162120.cmg	.90	.089	.307	39	0
	ORT3.0VT_SN_bch_supl_can_t0001004h000v000p000f0_bag171224.cmg	.97	-.072	.160	39	1
	ORT3.0VT_SN_bch_supl_rot_t0001004h000v085p000f0_bag154608.cmg	.77	.113	.427	39	1
	ORT3.0VT_SN_bch_supl_rot_t0001004h000v085p000f0_bag185754.cmg	.54	.362	.505	39	0
	ORT3.0VT_SN_bcl_suph_can_t0001004h000v000p000f0_bag103518.cmg	.95	.102	.223	39	0
	ORT3.0VT_SN_bcl_suph_can_t0001004h000v000p000f0_bag110851.cmg	.97	-.006	.160	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0001004h000v085p000f0_bag095013.cmg	.62	.183	.493	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0001004h000v085p000f0_bag131347.cmg	.23	.331	.427	39	0
	ORT3.0VT_SN_bcl_supl_can_t0001004h000v000p000f0_bag043228.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0001004h000v000p000f0_bag053746.cmg	.97	.186	.160	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0001004h000v085p000f0_bag102655.cmg	.92	.104	.270	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0001004h000v085p000f0_bag184122.cmg	.54	.334	.505	39	0

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 1	ORT3.0VT_SN_bch_suph_can_t0000703h000v000p000f0_bag101044.cmg	.36	.109	.486	39	1
	ORT3.0VT_SN_bch_suph_can_t0000703h000v000p000f0_bag113304.cmg	.90	.189	.307	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000703h000v085p000f0_bag080334.cmg	.15	.145	.366	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000703h000v085p000f0_bag152732.cmg	.41	.261	.498	39	0
	ORT3.0VT_SN_bch_supl_can_t0000703h000v000p000f0_bag152607.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000703h000v000p000f0_bag163153.cmg					0
	ORT3.0VT_SN_bch_supl_rot_t0000703h000v085p000f0_bag051340.cmg	.92	.281	.270	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000703h000v085p000f0_bag192324.cmg	.85	.194	.366	39	1
	ORT3.0VT_SN_bch_suph_can_t0000703h000v000p000f0_bag101044.cmg	.36	.109	.486	39	1
	ORT3.0VT_SN_bch_suph_can_t0000703h000v000p000f0_bag113304.cmg	.90	.189	.307	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000703h000v085p000f0_bag080334.cmg	.15	.145	.366	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000703h000v085p000f0_bag152732.cmg	.41	.261	.498	39	0
	ORT3.0VT_SN_bch_supl_can_t0000703h000v000p000f0_bag152607.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000703h000v000p000f0_bag163153.cmg					0
	ORT3.0VT_SN_bch_supl_rot_t0000703h000v085p000f0_bag051340.cmg	.92	.281	.270	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000703h000v085p000f0_bag192324.cmg	.85	.194	.366	39	1
Knife 2	ORT3.0VT_SN_bch_suph_can_t0000737h000v000p000f0_bag150426.cmg	.49	.335	.506	39	0
	ORT3.0VT_SN_bch_suph_can_t0000737h000v000p000f0_bag160528.cmg	.23	-.026	.427	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000737h000v085p000f0_bag080406.cmg	.36	.189	.486	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000737h000v085p000f0_bag080916.cmg	.41	.143	.498	39	1
	ORT3.0VT_SN_bch_supl_can_t0000737h000v000p000f0_bag051641.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000737h000v000p000f0_bag053722.cmg	.90	.431	.307	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000737h000v085p000f0_bag104227.cmg	.56	.153	.502	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000737h000v085p000f0_bag115332.cmg	.82	.150	.389	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000737h000v000p000f0_bag060614.cmg	.82	.118	.389	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000737h000v000p000f0_bag123054.cmg	.26	.093	.442	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000737h000v085p000f0_bag133646.cmg	.79	.384	.409	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000737h000v085p000f0_bag143402.cmg	.49	.406	.506	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000737h000v000p000f0_bag060037.cmg	.97	-.120	.160	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000737h000v000p000f0_bag080538.cmg	.97	-.158	.160	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000737h000v085p000f0_bag104810.cmg	.74	.158	.442	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000737h000v085p000f0_bag110421.cmg	.77	.149	.427	39	1

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 3	ORT3.0VT_SN_bch_suph_can_t0000947h000v000p000f0_bag090917.cmg	.15	-.060	.366	39	1
	ORT3.0VT_SN_bch_suph_can_t0000947h000v000p000f0_bag114206.cmg	.13	.048	.339	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000947h085v000p000f0_bag060306.cmg	.82	.393	.389	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000947h085v000p000f0_bag105846.cmg	.49	-.087	.506	39	1
	ORT3.0VT_SN_bch_supl_can_t0000947h000v000p000f0_bag143554.cmg	.67	.259	.478	39	1
	ORT3.0VT_SN_bch_supl_can_t0000947h000v000p000f0_bag152534.cmg	.92	.264	.270	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000947h085v000p000f0_bag184230.cmg	.79	.403	.409	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000947h085v000p000f0_bag184611.cmg	.77	.142	.427	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000947h000v000p000f0_bag111939.cmg	.46	-.195	.505	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000947h000v000p000f0_bag182224.cmg	.15	-.127	.366	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000947h085v000p000f0_bag102541.cmg	.28	.341	.456	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000947h085v000p000f0_bag211119.cmg	.21	-.080	.409	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000947h000v000p000f0_bag052822.cmg	.90	.149	.307	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000947h000v000p000f0_bag110533.cmg					1
	ORT3.0VT_SN_bcl_supl_rot_t0000947h085v000p000f0_bag053343.cmg	.87	.472	.339	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000947h085v000p000f0_bag103618.cmg	.72	.224	.456	39	1
Knife 4	ORT3.0VT_SN_bch_suph_can_t0000963h000v000p000f0_bag113953.cmg	.69	.314	.468	39	1
	ORT3.0VT_SN_bch_suph_can_t0000963h000v000p000f0_bag173329.cmg	.74	.368	.442	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000963h085v000p000f0_bag120120.cmg	.18	-.092	.389	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000963h085v000p000f0_bag170255.cmg	.10	-.283	.307	39	1
	ORT3.0VT_SN_bch_supl_can_t0000963h000v000p000f0_bag152524.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000963h000v000p000f0_bag154049.cmg	.95	.116	.223	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000963h085v000p000f0_bag144634.cmg	.64	.535	.486	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000963h085v000p000f0_bag151542.cmg	.38	.494	.493	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000963h000v000p000f0_bag160943.cmg	.31	.026	.468	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000963h000v000p000f0_bag174956.cmg	.23	.049	.427	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000963h085v000p000f0_bag112122.cmg	.77	.272	.427	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000963h085v000p000f0_bag112409.cmg	.18	.224	.389	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000963h000v000p000f0_bag110815.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000963h000v000p000f0_bag124015.cmg					0
	ORT3.0VT_SN_bcl_supl_rot_t0000963h085v000p000f0_bag175145.cmg	.64	.140	.486	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000963h085v000p000f0_bag211800.cmg	.74	.203	.442	39	0

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 5	ORT3.0VT_SN_bch_suph_can_t0000797h000v000p000f0_bag130643.cmg	.97	.281	.160	39	0
	ORT3.0VT_SN_bch_suph_can_t0000797h000v000p000f0_bag164459.cmg	.82	.118	.389	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000797h085v000p000f0_bag061504.cmg	.72	.363	.456	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000797h085v000p000f0_bag105651.cmg	.26	-.063	.442	39	1
	ORT3.0VT_SN_bch_supl_can_t0000797h000v000p000f0_bag055700.cmg	.97	-.149	.160	39	1
	ORT3.0VT_SN_bch_supl_can_t0000797h000v000p000f0_bag060253.cmg	.97	.339	.160	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000797h085v000p000f0_bag154017.cmg					1
	ORT3.0VT_SN_bch_supl_rot_t0000797h085v000p000f0_bag161804.cmg	.97	.339	.160	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000797h000v000p000f0_bag154450.cmg					1
	ORT3.0VT_SN_bcl_suph_can_t0000797h000v000p000f0_bag195913.cmg	.97	.099	.160	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000797h085v000p000f0_bag121823.cmg	.82	.067	.389	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000797h085v000p000f0_bag164246.cmg	.97	.281	.160	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000797h000v000p000f0_bag153201.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000797h000v000p000f0_bag183236.cmg					0
	ORT3.0VT_SN_bcl_supl_rot_t0000797h085v000p000f0_bag185732.cmg					1
	ORT3.0VT_SN_bcl_supl_rot_t0000797h085v000p000f0_bag200827.cmg					0
Knife 6	ORT3.0VT_SN_bch_suph_can_t0000864h000v000p000f0_bag054232.cmg	.13	.062	.339	39	0
	ORT3.0VT_SN_bch_suph_can_t0000864h000v000p000f0_bag161646.cmg	.21	-.202	.409	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000864h000v085p000f0_bag155755.cmg	.08	.159	.270	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000864h000v085p000f0_bag171321.cmg	.23	-.101	.427	39	1
	ORT3.0VT_SN_bch_supl_can_t0000864h000v000p000f0_bag083722.cmg	.77	.433	.427	39	0
	ORT3.0VT_SN_bch_supl_can_t0000864h000v000p000f0_bag101608.cmg	.74	.357	.442	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000864h000v085p000f0_bag130028.cmg	.31	-.117	.468	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000864h000v085p000f0_bag191240.cmg	.03	.035	.160	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000864h000v000p000f0_bag071445.cmg	.08	.103	.270	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000864h000v000p000f0_bag152442.cmg	.15	.365	.366	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000864h000v085p000f0_bag075406.cmg	.15	-.168	.366	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000864h000v085p000f0_bag152857.cmg	.05	.030	.223	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000864h000v000p000f0_bag054355.cmg	.95	-.137	.223	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000864h000v000p000f0_bag164845.cmg	.97	-.006	.160	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000864h000v085p000f0_bag094428.cmg	.03	.130	.160	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000864h000v085p000f0_bag161156.cmg	.05	.119	.223	39	1

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 7	ORT3.0VT_SN_bch_suph_can_t0000875h000v000p000f0_bag164836.cmg	.92	.309	.270	39	1
	ORT3.0VT_SN_bch_suph_can_t0000875h000v000p000f0_bag191518.cmg	.74	.326	.442	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000875h000v085p000f0_bag054701.cmg	.33	-.021	.478	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000875h000v085p000f0_bag114742.cmg	.28	-.087	.456	39	1
	ORT3.0VT_SN_bch_supl_can_t0000875h000v000p000f0_bag074102.cmg					1
	ORT3.0VT_SN_bch_supl_can_t0000875h000v000p000f0_bag204226.cmg	.77	.243	.427	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000875h000v085p000f0_bag053242.cmg	.36	.243	.486	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000875h000v085p000f0_bag111020.cmg	.31	.324	.468	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000875h000v000p000f0_bag103507.cmg	.92	.218	.270	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000875h000v000p000f0_bag191026.cmg	.92	.229	.270	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000875h000v085p000f0_bag093428.cmg	.18	.160	.389	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000875h000v085p000f0_bag163525.cmg	.05	.030	.223	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000875h000v000p000f0_bag060405.cmg	.97	.090	.160	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000875h000v000p000f0_bag201204.cmg	.97	-.072	.160	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000875h000v085p000f0_bag155542.cmg	.44	.196	.502	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000875h000v085p000f0_bag162226.cmg	.18	.267	.389	39	0
Knife 8	ORT3.0VT_SN_bch_suph_can_t0000934h000v000p000f0_bag113156.cmg	.46	.527	.505	39	0
	ORT3.0VT_SN_bch_suph_can_t0000934h000v000p000f0_bag193324.cmg	.13	.112	.339	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000934h085v000p000f0_bag135812.cmg	.26	.093	.442	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000934h085v000p000f0_bag191138.cmg	.28	-.074	.456	39	1
	ORT3.0VT_SN_bch_supl_can_t0000934h000v000p000f0_bag074858.cmg	.79	.262	.409	39	1
	ORT3.0VT_SN_bch_supl_can_t0000934h000v000p000f0_bag145052.cmg	.67	.301	.478	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000934h085v000p000f0_bag132719.cmg	.62	.086	.493	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000934h085v000p000f0_bag202907.cmg	.23	.121	.427	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000934h000v000p000f0_bag065513.cmg	.79	.074	.409	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000934h000v000p000f0_bag164049.cmg	.82	.461	.389	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000934h085v000p000f0_bag055134.cmg	.46	.301	.505	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000934h085v000p000f0_bag061202.cmg	.13	.053	.339	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000934h000v000p000f0_bag080427.cmg					1
	ORT3.0VT_SN_bcl_supl_can_t0000934h000v000p000f0_bag131520.cmg	.92	.424	.270	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000934h085v000p000f0_bag145034.cmg	.79	.502	.409	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000934h085v000p000f0_bag154623.cmg	.74	.238	.442	39	1

Appendix 2: List of ORT items with difficulties, Item Scale Correlation and deleted items

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Gun 1	ORT3.0VT_SN_bch_suph_can_t0000721h000v000p000f0_bag114847.cmg	.7436	.243	.44236	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000721h085v000p000f0_bag154343.cmg	.5897	.127	.49831	39	0
	ORT3.0VT_SN_bch_supl_can_t0000721h000v000p000f0_bag222358.cmg	.9744	.133	.16013	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000721h085v000p000f0_bag193034.cmg	.9744	.100	.16013	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000721h000v000p000f0_bag145436.cmg	.7692	.326	.42683	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000721h085v000p000f0_bag102457.cmg	.3846	.167	.49286	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000721h000v000p000f0_bag110138.cmg	.9744	.022	.16013	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000721h085v000p000f0_bag110600.cmg	1.0000	.000	.00000		0
Gun 2	ORT3.0VT_SN_bch_suph_can_t0000725h000v000p000f0_bag043459.cmg	.7179	.130	.45588	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000725h000v085p000f0_bag064402.cmg	.6923	.561	.46757	39	0
	ORT3.0VT_SN_bch_supl_can_t0000725h000v000p000f0_bag121039.cmg	1.0000	.000	.00000		0
	ORT3.0VT_SN_bch_supl_rot_t0000725h000v085p000f0_bag122942.cmg	.8462	.203	.36552	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000725h000v000p000f0_bag145106.cmg	.9744	.100	.16013	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000725h000v085p000f0_bag051801.cmg	.8205	.197	.38878	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000725h000v000p000f0_bag143714.cmg	1.0000	.000	.00000		0
	ORT3.0VT_SN_bcl_supl_rot_t0000725h000v085p000f0_bag151842.cmg	.8974	.357	.30735	39	0
Gun 3	ORT3.0VT_SN_bch_suph_can_t0000726h000v000p000f0_bag051208.cmg	.8974	.222	.30735	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000726h085v000p000f0_bag183935.cmg	.8462	.066	.36552	39	1
	ORT3.0VT_SN_bch_supl_can_t0000726h000v000p000f0_bag193214.cmg	.9487	.127	.22346	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000726h085v000p000f0_bag114540.cmg	.9487	.320	.22346	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000726h000v000p000f0_bag073651.cmg	.7692	-.036	.42683	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000726h085v000p000f0_bag203941.cmg	.9487	.079	.22346	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000726h000v000p000f0_bag150937.cmg	.9744	.055	.16013	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000726h085v000p000f0_bag155840.cmg	.8718	.186	.33869	39	1
Gun 4	ORT3.0VT_SN_bch_suph_can_t0000904h000v000p000f0_bag190321.cmg	.5385	-.036	.50504	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000904h000v085p000f0_bag202224.cmg	.3333	.114	.47757	39	1
	ORT3.0VT_SN_bch_supl_can_t0000904h000v000p000f0_bag081337.cmg	.4359	.099	.50236	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000904h000v085p000f0_bag112658.cmg	.5385	.360	.50504	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000904h000v000p000f0_bag042226.cmg	.3077	.341	.46757	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000904h000v085p000f0_bag115433.cmg	.3846	.174	.49286	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000904h000v000p000f0_bag165611.cmg	.6923	.041	.46757	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000904h000v085p000f0_bag181308.cmg	.6667	.360	.47757	39	1

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Gun 5	ORT3.0VT_SN_bch_suph_can_t0000650h000v000p000f0_bag083719.cmg	.8462	.066	.36552	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000650h000v085p000f0_bag190753.cmg	.6923	.291	.46757	39	1
	ORT3.0VT_SN_bch_supl_can_t0000650h000v000p000f0_bag111128.cmg	.9744	-.101	.16013	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000650h000v085p000f0_bag163131.cmg	.8205	.137	.38878	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000650h000v000p000f0_bag171303.cmg	.8462	.164	.36552	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000650h000v085p000f0_bag103323.cmg	.6923	-.012	.46757	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000650h000v000p000f0_bag183202.cmg	.9231	-.040	.26995	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000650h000v085p000f0_bag161740.cmg	.9487	.016	.22346	39	1
Gun 6	ORT3.0VT_SN_bch_suph_can_t0000780h000v000p000f0_bag111847.cmg	.7179	.289	.45588	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000780h085v000p000f0_bag201353.cmg	.6923	.030	.46757	39	0
	ORT3.0VT_SN_bch_supl_can_t0000780h000v000p000f0_bag104955.cmg	.7949	.477	.40907	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000780h085v000p000f0_bag191652.cmg	.9744	.390	.16013	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000780h000v000p000f0_bag111129.cmg	.8974	.175	.30735	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000780h085v000p000f0_bag193857.cmg	.8718	.075	.33869	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000780h000v000p000f0_bag183956.cmg	1.0000	.000	.00000	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000780h085v000p000f0_bag163223.cmg	.9231	.278	.26995	39	0
Gun 7	ORT3.0VT_SN_bch_suph_can_t0000912h000v000p000f0_bag102920.cmg	.9744	-.023	.16013	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000912h085v000p000f0_bag100956.cmg	.8205	.211	.38878	39	1
	ORT3.0VT_SN_bch_supl_can_t0000912h000v000p000f0_bag161725.cmg	1.0000	.000	.00000	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000912h085v000p000f0_bag193227.cmg	1.0000	.000	.00000	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000912h000v000p000f0_bag110446.cmg	.9487	.008	.22346	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000912h085v000p000f0_bag200353.cmg	.9744	.100	.16013	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000912h000v000p000f0_bag080955.cmg	.9744	.167	.16013	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000912h085v000p000f0_bag160818.cmg	1.0000	.000	.00000	39	1
Gun 8	ORT3.0VT_SN_bch_suph_can_t0001004h000v000p000f0_bag170826.cmg	.6923	.041	.46757	39	0
	ORT3.0VT_SN_bch_suph_rot_t0001004h000v085p000f0_bag192140.cmg	.3846	.149	.49286	39	0
	ORT3.0VT_SN_bch_supl_can_t0001004h000v000p000f0_bag162120.cmg	.8974	.251	.30735	39	0
	ORT3.0VT_SN_bch_supl_rot_t0001004h000v085p000f0_bag185754.cmg	.5385	.303	.50504	39	0
	ORT3.0VT_SN_bcl_suph_can_t0001004h000v000p000f0_bag103518.cmg	.9487	.024	.22346	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0001004h000v085p000f0_bag131347.cmg	.2308	.311	.42683	39	0
	ORT3.0VT_SN_bcl_supl_can_t0001004h000v000p000f0_bag053746.cmg	.9744	.100	.16013	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0001004h000v085p000f0_bag184122.cmg	.5385	.288	.50504	39	0

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 1	ORT3.0VT_SN_bch_suph_can_t0000703h000v000p000f0_bag113304.cmg	.8974	.163	.30735	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000703h000v085p000f0_bag152732.cmg	.4103	.223	.49831	39	0
	ORT3.0VT_SN_bch_supl_can_t0000703h000v000p000f0_bag163153.cmg	1.0000	.000	.00000	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000703h000v085p000f0_bag051340.cmg	.9231	.292	.26995	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000703h000v000p000f0_bag151755.cmg	.4359	.398	.50236	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000703h000v085p000f0_bag183651.cmg	.4359	.427	.50236	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000703h000v000p000f0_bag185355.cmg	.9487	.264	.22346	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000703h000v085p000f0_bag054617.cmg	.7436	.279	.44236	39	0
Knife 2	ORT3.0VT_SN_bch_suph_can_t0000737h000v000p000f0_bag150426.cmg	.4872	.326	.50637	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000737h000v085p000f0_bag080406.cmg	.3590	.041	.48597	39	0
	ORT3.0VT_SN_bch_supl_can_t0000737h000v000p000f0_bag053722.cmg	.8974	.357	.30735	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000737h000v085p000f0_bag104227.cmg	.5641	.071	.50236	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000737h000v000p000f0_bag060614.cmg	.8205	.201	.38878	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000737h000v085p000f0_bag143402.cmg	.4872	.384	.50637	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000737h000v000p000f0_bag060037.cmg	.9744	.022	.16013	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000737h000v085p000f0_bag104810.cmg	.7436	.153	.44236	39	0
Knife 3	ORT3.0VT_SN_bch_suph_can_t0000947h000v000p000f0_bag114206.cmg	.1282	-.058	.33869	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000947h085v000p000f0_bag060306.cmg	.8205	.317	.38878	39	1
	ORT3.0VT_SN_bch_supl_can_t0000947h000v000p000f0_bag152534.cmg	.9231	.239	.26995	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000947h085v000p000f0_bag184230.cmg	.7949	.383	.40907	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000947h000v000p000f0_bag182224.cmg	.1538	-.091	.36552	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000947h085v000p000f0_bag102541.cmg	.2821	.236	.45588	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000947h000v000p000f0_bag052822.cmg	.8974	.380	.30735	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000947h085v000p000f0_bag053343.cmg	.8718	.335	.33869	39	1
Knife 4	ORT3.0VT_SN_bch_suph_can_t0000963h000v000p000f0_bag173329.cmg	.7436	.255	.44236	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000963h085v000p000f0_bag120120.cmg	.1795	-.161	.38878	39	1
	ORT3.0VT_SN_bch_supl_can_t0000963h000v000p000f0_bag154049.cmg	.9487	.248	.22346	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000963h085v000p000f0_bag144634.cmg	.6410	.545	.48597	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000963h000v000p000f0_bag174956.cmg	.2308	-.022	.42683	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000963h085v000p000f0_bag112122.cmg	.7692	.271	.42683	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000963h000v000p000f0_bag124015.cmg	1.0000	.000	.00000	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000963h085v000p000f0_bag211800.cmg	.7436	.292	.44236	39	1

Item	Itemcode	*M*	Adjusted Item Scale Correlation	*SD*	*N*	Delete (1=yes)
Knife 5	ORT3.0VT_SN_bch_suph_can_t0000797h000v000p000f0_bag130643.cmg	.9744	.323	.16013	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000797h085v000p000f0_bag061504.cmg	.7179	.453	.45588	39	1
	ORT3.0VT_SN_bch_supl_can_t0000797h000v000p000f0_bag060253.cmg	.9744	.211	.16013	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000797h085v000p000f0_bag161804.cmg	.9744	.211	.16013	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000797h000v000p000f0_bag195913.cmg	.9744	.066	.16013	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000797h085v000p000f0_bag164246.cmg	.9744	.323	.16013	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000797h000v000p000f0_bag183236.cmg	1.0000	.000	.00000	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000797h085v000p000f0_bag200827.cmg	1.0000	.000	.00000	39	1
Knife 6	ORT3.0VT_SN_bch_suph_can_t0000864h000v000p000f0_bag054232.cmg	.1282	-.094	.33869	39	1
	ORT3.0VT_SN_bch_suph_rot_t0000864h000v085p000f0_bag155755.cmg	.0769	.149	.26995	39	1
	ORT3.0VT_SN_bch_supl_can_t0000864h000v000p000f0_bag083722.cmg	.7692	.390	.42683	39	1
	ORT3.0VT_SN_bch_supl_rot_t0000864h000v085p000f0_bag191240.cmg	.0256	.001	.16013	39	1
	ORT3.0VT_SN_bcl_suph_can_t0000864h000v000p000f0_bag152442.cmg	.1538	.470	.36552	39	1
	ORT3.0VT_SN_bcl_suph_rot_t0000864h000v085p000f0_bag152857.cmg	.0513	-.006	.22346	39	1
	ORT3.0VT_SN_bcl_supl_can_t0000864h000v000p000f0_bag164845.cmg	.9744	-.034	.16013	39	1
	ORT3.0VT_SN_bcl_supl_rot_t0000864h000v085p000f0_bag094428.cmg	.0256	.101	.16013	39	1
Knife 7	ORT3.0VT_SN_bch_suph_can_t0000875h000v000p000f0_bag191518.cmg	.7436	.255	.44236	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000875h000v085p000f0_bag054701.cmg	.3333	.057	.47757	39	0
	ORT3.0VT_SN_bch_supl_can_t0000875h000v000p000f0_bag204226.cmg	.7692	.153	.42683	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000875h000v085p000f0_bag111020.cmg	.3077	.291	.46757	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000875h000v000p000f0_bag191026.cmg	.9231	.365	.26995	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000875h000v085p000f0_bag093428.cmg	.1795	.017	.38878	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000875h000v000p000f0_bag060405.cmg	.9744	.111	.16013	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000875h000v085p000f0_bag162226.cmg	.1795	.100	.38878	39	0
Knife 8	ORT3.0VT_SN_bch_suph_can_t0000934h000v000p000f0_bag113156.cmg	.4615	.461	.50504	39	0
	ORT3.0VT_SN_bch_suph_rot_t0000934h085v000p000f0_bag135812.cmg	.2564	.090	.44236	39	0
	ORT3.0VT_SN_bch_supl_can_t0000934h000v000p000f0_bag145052.cmg	.6667	.291	.47757	39	0
	ORT3.0VT_SN_bch_supl_rot_t0000934h085v000p000f0_bag202907.cmg	.2308	.125	.42683	39	0
	ORT3.0VT_SN_bcl_suph_can_t0000934h000v000p000f0_bag164049.cmg	.8205	.322	.38878	39	0
	ORT3.0VT_SN_bcl_suph_rot_t0000934h085v000p000f0_bag055134.cmg	.4615	.226	.50504	39	0
	ORT3.0VT_SN_bcl_supl_can_t0000934h000v000p000f0_bag131520.cmg	.9231	.506	.26995	39	0
	ORT3.0VT_SN_bcl_supl_rot_t0000934h085v000p000f0_bag145034.cmg	.7949	.387	.40907	39	0

Appendix 3
List of ORT items with Item scale correlation without a prohibited item (deletion step 2)

Item	Itemcode	Adjusted Item Scale Correlation	Delete (1=yes)
1	ORT3.0VT_N_bch_bag051118.cmg	.296	0
2	ORT3.0VT_N_bch_bag053040.cmg	.233	0
3	ORT3.0VT_N_bch_bag053727.cmg	.012	1
4	ORT3.0VT_N_bch_bag054856.cmg	.390	0
5	ORT3.0VT_N_bch_bag055300.cmg	.030	1
6	ORT3.0VT_N_bch_bag055657.cmg	.292	0
7	ORT3.0VT_N_bch_bag055706.cmg	-.120	1
8	ORT3.0VT_N_bch_bag060509.cmg	.017	1
9	ORT3.0VT_N_bch_bag061142.cmg	.055	1
10	ORT3.0VT_N_bch_bag061425.cmg	.420	0
11	ORT3.0VT_N_bch_bag061457.cmg	.253	0
12	ORT3.0VT_N_bch_bag061616.cmg	-.015	1
13	ORT3.0VT_N_bch_bag062111.cmg	.000	1
14	ORT3.0VT_N_bch_bag062833.cmg	-.231	1
15	ORT3.0VT_N_bch_bag064010.cmg	.394	0
16	ORT3.0VT_N_bch_bag064414.cmg	.325	0
17	ORT3.0VT_N_bch_bag065211.cmg	.299	0
18	ORT3.0VT_N_bch_bag070003.cmg	-.130	1
19	ORT3.0VT_N_bch_bag070639.cmg	-.056	1
20	ORT3.0VT_N_bch_bag072239.cmg	.312	0
21	ORT3.0VT_N_bch_bag075847.cmg	.100	1
22	ORT3.0VT_N_bch_bag080224.cmg	-.026	1
23	ORT3.0VT_N_bch_bag083333.cmg	.013	1
24	ORT3.0VT_N_bch_bag091309.cmg	.047	1
25	ORT3.0VT_N_bch_bag092234.cmg	.178	0
26	ORT3.0VT_N_bch_bag093955.cmg	.031	1
27	ORT3.0VT_N_bch_bag101437.cmg	.229	0
28	ORT3.0VT_N_bch_bag110714.cmg	.030	1
29	ORT3.0VT_N_bch_bag110736.cmg	.080	1
30	ORT3.0VT_N_bch_bag111621.cmg	.000	1

Item	Itemcode	Adjusted Item Scale Correlation	Delete (1=yes)
31	ORT3.0VT_N_bch_bag120013.cmg	-.143	1
32	ORT3.0VT_N_bch_bag121530.cmg	.055	1
33	ORT3.0VT_N_bch_bag122546.cmg	.075	1
34	ORT3.0VT_N_bch_bag122849.cmg	.132	0
35	ORT3.0VT_N_bch_bag123712.cmg	.255	0
36	ORT3.0VT_N_bch_bag141018.cmg	.079	1
37	ORT3.0VT_N_bch_bag150816.cmg	.000	1
38	ORT3.0VT_N_bch_bag150931.cmg	.287	0
39	ORT3.0VT_N_bch_bag151935.cmg	.308	0
40	ORT3.0VT_N_bch_bag152107.cmg	.390	0
41	ORT3.0VT_N_bch_bag155412.cmg	.205	0
42	ORT3.0VT_N_bch_bag155413.cmg	.065	1
43	ORT3.0VT_N_bch_bag160937.cmg	.007	1
44	ORT3.0VT_N_bch_bag162230.cmg	.151	0
45	ORT3.0VT_N_bch_bag162431.cmg	.059	1
46	ORT3.0VT_N_bch_bag163331.cmg	.247	0
47	ORT3.0VT_N_bch_bag171142.cmg	.245	0
48	ORT3.0VT_N_bch_bag171215.cmg	.149	0
49	ORT3.0VT_N_bch_bag182736.cmg	.121	0
50	ORT3.0VT_N_bch_bag183309.cmg	.485	0
51	ORT3.0VT_N_bch_bag183451.cmg	.441	0
52	ORT3.0VT_N_bch_bag183923.cmg	.191	0
53	ORT3.0VT_N_bch_bag192013.cmg	.205	0
54	ORT3.0VT_N_bch_bag192202.cmg	.111	1
55	ORT3.0VT_N_bch_bag192750.cmg	.197	0
56	ORT3.0VT_N_bch_bag193008.cmg	.115	0
57	ORT3.0VT_N_bch_bag193152.cmg	-.132	1
58	ORT3.0VT_N_bch_bag193656.cmg	.274	0
59	ORT3.0VT_N_bch_bag194101.cmg	-.012	1
60	ORT3.0VT_N_bch_bag194118.cmg	.014	1
61	ORT3.0VT_N_bch_bag194541.cmg	.118	0
62	ORT3.0VT_N_bch_bag215451.cmg	-.056	1
63	ORT3.0VT_N_bch_bag221709.cmg	.251	0
64	ORT3.0VT_N_bch_bag224207.cmg	.055	1

Item	Itemcode	Adjusted Item Scale Correlation	Delete (1=yes)
65	ORT3.0VT_N_bcl_bag042650.cmg	.000	1
66	ORT3.0VT_N_bcl_bag044903.cmg	-.023	1
67	ORT3.0VT_N_bcl_bag052716.cmg	.022	1
68	ORT3.0VT_N_bcl_bag054311.cmg	.070	1
69	ORT3.0VT_N_bcl_bag054458.cmg	.378	0
70	ORT3.0VT_N_bcl_bag054504.cmg	-.189	1
71	ORT3.0VT_N_bcl_bag054800.cmg	.390	0
72	ORT3.0VT_N_bcl_bag055309.cmg	.079	1
73	ORT3.0VT_N_bcl_bag055619.cmg	.095	1
74	ORT3.0VT_N_bcl_bag061649.cmg	.024	1
75	ORT3.0VT_N_bcl_bag061841.cmg	.000	1
76	ORT3.0VT_N_bcl_bag063246.cmg	.185	0
77	ORT3.0VT_N_bcl_bag063743.cmg	.000	1
78	ORT3.0VT_N_bcl_bag064343.cmg	.379	0
79	ORT3.0VT_N_bcl_bag064555.cmg	.000	1
80	ORT3.0VT_N_bcl_bag065236.cmg	-.222	1
81	ORT3.0VT_N_bcl_bag065926.cmg	-.023	1
82	ORT3.0VT_N_bcl_bag071417.cmg	-.239	1
83	ORT3.0VT_N_bcl_bag075934.cmg	-.151	1
84	ORT3.0VT_N_bcl_bag080859.cmg	-.062	1
85	ORT3.0VT_N_bcl_bag081909.cmg	.312	0
86	ORT3.0VT_N_bcl_bag083611.cmg	.008	1
87	ORT3.0VT_N_bcl_bag084233.cmg	.167	0
88	ORT3.0VT_N_bcl_bag094332.cmg	-.223	1
89	ORT3.0VT_N_bcl_bag100614.cmg	.047	1
90	ORT3.0VT_N_bcl_bag102130.cmg	.000	1

Item	Itemcode	Adjusted Item Scale Correlation	Delete (1=yes)
91	ORT3.0VT_N_bcl_bag110338.cmg	-.012	1
92	ORT3.0VT_N_bcl_bag112546.cmg	.055	1
93	ORT3.0VT_N_bcl_bag114328.cmg	.506	0
94	ORT3.0VT_N_bcl_bag120023.cmg	-.002	1
95	ORT3.0VT_N_bcl_bag121831.cmg	.122	0
96	ORT3.0VT_N_bcl_bag140545.cmg	.111	0
97	ORT3.0VT_N_bcl_bag140646.cmg	.199	0
98	ORT3.0VT_N_bcl_bag145015.cmg	.000	1
99	ORT3.0VT_N_bcl_bag145301.cmg	.122	0
100	ORT3.0VT_N_bcl_bag150540.cmg	.008	1
101	ORT3.0VT_N_bcl_bag151030.cmg	.198	0
102	ORT3.0VT_N_bcl_bag152706.cmg	.133	0
103	ORT3.0VT_N_bcl_bag153057.cmg	.133	0
104	ORT3.0VT_N_bcl_bag153115.cmg	.146	0
105	ORT3.0VT_N_bcl_bag153747.cmg	.151	0
106	ORT3.0VT_N_bcl_bag160202.cmg	.133	0
107	ORT3.0VT_N_bcl_bag161109.cmg	-.151	1
108	ORT3.0VT_N_bcl_bag161958.cmg	.191	0
109	ORT3.0VT_N_bcl_bag162102.cmg	.285	0
110	ORT3.0VT_N_bcl_bag164452.cmg	.000	1
111	ORT3.0VT_N_bcl_bag170953.cmg	.022	1
112	ORT3.0VT_N_bcl_bag171326.cmg	.203	0
113	ORT3.0VT_N_bcl_bag172035.cmg	.233	0
114	ORT3.0VT_N_bcl_bag172331.cmg	.256	0
115	ORT3.0VT_N_bcl_bag174908.cmg	.272	0
116	ORT3.0VT_N_bcl_bag175854.cmg	.000	1
117	ORT3.0VT_N_bcl_bag180559.cmg	.022	1
118	ORT3.0VT_N_bcl_bag180937.cmg	.127	0
119	ORT3.0VT_N_bcl_bag181920.cmg	.323	0
120	ORT3.0VT_N_bcl_bag185822.cmg	.344	0
121	ORT3.0VT_N_bcl_bag190431.cmg	.055	1
122	ORT3.0VT_N_bcl_bag191037.cmg	.368	0
123	ORT3.0VT_N_bcl_bag192548.cmg	-.183	1
124	ORT3.0VT_N_bcl_bag194632.cmg	.193	0
125	ORT3.0VT_N_bcl_bag195340.cmg	.386	0
126	ORT3.0VT_N_bcl_bag195555.cmg	.296	0
127	ORT3.0VT_N_bcl_bag195650.cmg	.390	0
128	ORT3.0VT_N_bcl_bag203006.cmg	.345	0