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Analysis of figure recognition on the modified MT Beta-86 Test for adaptation: description and discussion of methodological aspects

Análise do reconhecimento das figuras do Teste MT Beta-86 modificado para uma adaptação: descrição e discussão de aspectos metodológicos

ABSTRACT

Purpose: The purpose of this study was to analyze the recognition of figures from the modified MT Beta-86 test for subsequent refinement and adaptation of this language assessment instrument. **Methods:** This study was organized into two parts. The first part of the study involved 61 subjects with educational level higher than nine years. Naming of 266 visual *stimuli* was elicited and concordance among participants on figure naming was also determined. Concordance of responses was assessed using Cochrane's test at a 5% level of significance. Some visual *stimuli* were subsequently re-designed and images were replaced. The second part of this study involved the re-testing of the new images among 110 individuals ranging in age from 18 to 75 years of both genders, stratified into four educational bands (A: 1–4 years; B: 5–8 years; C: 9–11 years; and D: more than 12 years). *Stimuli* with concordance level of 70% or higher were considered adequate. **Results:** In part A of the study, from the index of agreement of naming, the figures considered suitable for inclusion in the adapted version were selected. In part B, all the figures had a response concordance level over 70%. **Conclusion:** Figures in the Modified MT Beta-86 test suitable for retention in the new version of the instrument were identified. Analysis of low sample recognition was used to identify boards for replacement, and those for retention, in the new version of the test.

RESUMO

Objetivo: Analisar o reconhecimento das figuras do Teste MT Beta-86 modificado, descrever e discutir aspectos metodológicos da adaptação desse instrumento de avaliação da linguagem. **Métodos:** O estudo foi dividido em duas partes. Na primeira, participaram 61 indivíduos com escolaridade superior a 9 anos. Solicitou-se nomeação de 266 estímulos visuais e verificou-se a concordância da nomeação das figuras entre os participantes. Para a concordância de respostas, utilizou-se o teste de Cochran, com nível de significância de 5%. Em seguida, alguns estímulos visuais foram redesenhados, e as imagens foram substituídas. As imagens passaram pela segunda parte do estudo, da qual participaram 110 indivíduos divididos em 4 faixas de escolaridade (A: 1 a 4 anos; B: 5 a 8 anos; C: 9 a 11 anos e D: acima de 12 anos), de ambos os sexos e idades entre 18 e 75 anos. Foram considerados adequados para serem utilizados na avaliação de linguagem os estímulos com índice de concordância de, no mínimo, 70%. **Resultados:** Na parte A do estudo, a partir do índice de concordância de nomeação das figuras, foram escolhidas as consideradas apropriadas para fazer parte do teste em sua versão em adaptação. A segunda parte demonstrou que todas as figuras selecionadas apresentaram concordância de resposta acima de 70%. **Conclusão:** Identificaram-se quais figuras do Teste MT Beta-86 modificado poderão continuar presentes na próxima versão do instrumento e, por meio da análise do baixo reconhecimento populacional, verificaram-se quais pranchas deverão ser substituídas e quais poderão compor a nova versão do teste.

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INTRODUCTION

The use of translated tools for the assessment of linguistic and cognitive functions is very common in the routine of Speech Therapy and Neuropsychology professionals. In addition to its cultural and linguistic patterns from other country, the responses by patients are also evaluated according to normality standards established by international studies[1]. Besides, the published literature often reports the lack of tools for the assessment of linguistic and cognitive abilities that are adequate to the Brazilian social, cultural, and linguistic specificities[1-4].

In this context, when linguistic components are evaluated, the use of stimuli and instructions only translated into other language becomes more limiting, because language conveys the examination of the language itself. Among the methods used for the examination of aphasia, the published literature highlights standardized instruments that allow comparisons between the performance of brain-damaged patients compared to healthy subjects with the same age and education level, or even compared with the person having brain injury. Comparison may be intra-subject when the test is applied longitudinally, thus allowing pre- and post-intervention analysis.

One instrument that has been commonly referred to in the published literature[3,4], is The Montreal Toulouse (Modified MT Beta-86) test[5], which has resulted from the cooperation between the French and the Canadian researchers of aphasia. The Montreal Toulouse (Modified MT Beta-86) test of aphasia comprises tasks that enable characterization of graphic and oral emission, listening and graphics understanding, and repetition and fluency. This test was designed to verify the changes of language found in aphasic individuals, i.e., acquired language changes.

The protocol of the test[5] was adapted by Parente et al. in the 1980s, but it was not published. In Brazil, many clinicians and researchers have had contact with the material and began to use it in their clinical practice and/or in research; however, studies[4,6-9] have been performed with this protocol over the years and detected the need of adaptation. For the Montreal Toulouse protocol, to be a diagnostic tool capable of measuring linguistic process changes caused by brain damage, further studies aimed at the creation of stimuli fitted to the Brazilian linguistic reality are, extremely important.

Based on the evidence of the need for modifications by previous studies[4,6], and considering the need to prepare an updated Brazilian version of the instrument, an adaptation was proposed[10]. The first part of this process was to analyze the picture recognition by Modified MT Beta-86 test applied to a sample from São Paulo, aiming at reviewing, improving, and updating the instrument. The purpose of this study was, therefore, to assess picture recognition in the Modified MT Beta-86 test to list the stimuli that could be used in an adapted version of this language assessment instrument, besides describing and discussing methodological aspects of the process of adaptation.

METHODS

This study was conducted at the Center for Hearing Research in Neurological Studies, Federal University of São Paulo – UNIFESP, and approved by the Research Ethics committee of the institution (Protocol No. 0935/08). All participants were informed about the study and signed the informed consent form.

This study was divided into two parts, i.e., A and B, with the focus on didactics. In part A, an investigation was conducted on the recognition of figures of the test by subjects, and in Part B the figures of the test presenting high rates of recognition were maintained and mixed with other from the previous study[11], so that those from the new version of the instrument could be selected.

Part A

The first collective collection was performed in this part of the study, which consisted of 61 subjects.

Because low educational levels could lead to a low response agreement rate[4], the subjects selected for this study had received high schooling.

Inclusion criteria were investigated by a previous questionnaire, which included questions about both exclusion and inclusion criteria. Inclusion criteria were included the following: age above 18 years, and absence of speech disturbances and schooling of more than 13 years. Exclusion criteria included the following: diagnosis or history of hearing, psychiatric or visual disturbances and/or neurologic disorders such as history of head trauma with loss of consciousness more than 15 minutes, and history of epilepsy and previous or current use of psychotropic drugs.

The selected participants were asked to name words and describe scenes by writing phrases after 266 visual stimuli. We analyzed the correlation between the written stimuli and figures composing the modified Beta MT-86 test. Some visual stimuli were part of the modified Beta MT-86 test and some were from the study by Cycowicz et al[11]. Thus, we used the visual stimuli of the Montreal-Toulouse protocol for linguistic assessment of aphasia (modified MT Beta-86), adapted by Parente et al. (without reference), and a set of pictures of objects[9], totaling 266 figures. Figures from the modified MT-Beta 86 test were mixed to figures proposed by Cycowicz et al.[11], because their recognition had been previously studied in the Brazilian population[12]. In addition, we required figures in black and white, as those from the test, to replace the figures representing more up-to-date objects, or in case of low agreement rate between subjects as to the naming of a certain figure.

The MT-Beta 86 test is composed of 239 figures divided in 8 out of 17 tasks. The tasks presenting visual stimuli include oral comprehension, graphic comprehension, oral naming, and graphic naming. Out of 239 figures, 73 are considered target-stimuli figures. Only 73 target-stimuli figures were selected and analyzed by the sample, the other figures were considered to be distracting. The study by Cycowicz et al.[11] was composed of 400 figures that represented common objects in black and

white. To select figures that would compose the visual stimuli of this phase, we considered results from a previous study[12], ranking figures considered more familiar according to the Brazilian culture and those presenting a higher consensual naming rate, which totaled to 193 figures.

The proposal was to present the figures from the study by Cycowicz et al.[11] and target stimuli from the modified Beta MT-86 test mixed together, regardless of the subtests to which they belonged.

The target stimuli from the modified Beta MT-86 test were previously scanned, arranged randomly, and interspersed with the figures from the study by Miranda, Pompéia, and Bueno[12]. They were presented to participants in the Microsoft Office Power Point 2007 program in a silent room that would allow good visualization. We used a projector connected to the computer so the participants could see the visuals well. This procedure was repeated three times for groups of 20 or 21 participants.

The participants received a registration form for their answers, which was numbered according to the slides containing the figures. They named the figures in graphic naming task by collective collection, that is, each participant wrote in the registration form what they saw in the figures, with the following instruction: "Write the name of the figure or what the figure you see represents." The subjects were exposed to the figures for 20 seconds and if they came up with more than one word that should also be written down.

After writing the name of the figures presented in the slides, each participant gave their response in the form for response analysis. Then response agreement between the individuals was analyzed.

The data were analyzed qualitatively and quantitatively, i.e., responses from 61 individuals were marked, and based on the results obtained, we calculated the frequencies of responses. After that, we determined which figures presented response the agreement hierarchically.

For data analysis, the results were submitted to the statistical analysis team. To identify which of the 266 figures had response agreement in the population, we used the Cochrane test, with significance level set at 5%. For comparison, we initially formed a group of figures that stood out for having 100% of agreement in the sample.

This group was considered as the maximum agreement. All other agreement rates below 100% were tested by the Cochrane analysis interactively until a significant difference was found, thus identifying groups with similar amounts of correct responses. Groups of figures with similar recognition rate were then formed.

After conduction of Part A of this study, five expert judges (three speech therapists, a linguist, and a psychologist) analyzed the results, selected visual stimuli that could be part of the new test version, and requested re-drawing or replacement of figures in relation to the target figures and to the distracting ones, excluding certain items that would not compose subtests anymore. This part of the study consisted of 200 figures. Figures were redrawn and the stimuli from the modified MT Beta-86 test were submitted to the second part of the analysis (Part B).

Part B

In this part of the study, 110 subjects participated.

The sample population in this study aged from 18 to 75 years. The mean age was 38.03 (SD=26.16), and the mean schooling was 9.95 years (SD=2.12). The sample consisted of four schooling bands including 1 to 4 years, 5 to 8 years, 9 to 11 years, and 12 or more years of formal study, and all the groups held a similar number of subjects.

The sample had to be increased and distributed by schooling bands at this point, because the modified MT Beta-86 test would be used for all the schooling bands. Therefore, population recognition of figures that would be present in the test, was performed at different levels of schooling and in different age groups.

Inclusion criteria were obtained by a previous questionnaire with questions about both exclusion and inclusion criteria. Inclusion criterion was age above 18 years. Exclusion criteria included the following: diagnosis or history of hearing, psychiatric or visual disturbances and/or neurologic disorders such as history of head trauma with loss of consciousness more than 15 minutes, history of epilepsy, and previous or current use of psychotropic drugs.

Figures were distributed in nine tasks and presented to participants in the Microsoft Office Power Point 2007 program in a silent room for good visualization. A projector connected to the computer was used for a better presentation.

The participants received a registration form for their answers, which was numbered according to the slides containing the figures and to the tasks. The figures were presented in nine tasks shown by the collective collection. For figures representing words, each participant put a mark on a 0-10 scale of representativeness, following the orientation "Put a mark on how much (in a 0-10 scale 0, none, and 10 being the complete representation) the word represents the figure you see."

For figure representing phrases, the orientation was "Put a mark on how much (in a 0-10 scale: 0, none, and 10 being the complete representation) the phrases below represent the figure you see." For the figures of the naming tasks, the subjects were supposed to write down what they saw in the picture following the instruction: "You will be shown figures and must write down the names. If any other names come to your mind, write them down on the space intended to it (other names)".

The figures of the naming tasks that corresponded to semantic/hyperonym categories were put in other task, and subjects had to follow the instruction: "You will be shown figures and should name them according to the category they represent, that is, the group to which they belong. In case other names come to your mind, write them down in the space intended to it (other names)." Then, the participants had to write down those elements that were related to the images corresponding to semantic/hyperonym groups under the instruction of: "You will be shown figures and must write the name of the parts composing it, not the groups to which they belong. In case other names come to your mind, write them down in the space intended to it (other names)."

With regard to the figures of the naming verbs/actions tasks, participants should follow the following instruction: "Write down what is happening in the picture. In case other names come to your mind, write them down in the space intended to it (other names)."

Spelling errors were disregarded in this analysis.

The figures representing scenes were shown to participants with the following instruction: "Pretending you would tell a story based on this scene, what title would you give to that story?"

For figures corresponding to written assignments, the instruction was: "To which extent is the figure related to the given word? Put a mark in a 0-10 scale, 0, none, and 10 being the complete relation."

In case of figures representing phrases, the following instruction was given to the participants: "To which extent is the figure related to the given phrase? Put a mark in a 0-10 scale: 0, none, and 10 being the complete relation." Each figure was shown to subjects for 20 seconds.

After performing these tasks, each participant provided the response in the form for analysis, which took in to account the agreement of responses from the individuals. Stimuli with an agreement rate above 70% were considered adequate based on the results of the statistical test applied.

Statistical analysis was performed in this part of the study to compare figures from the modified MT Beta-86 test and those previously studied by Cycowicz et al.[11], to analyze which figures obtained the highest agreement rates between the groups. The group of figures had the response agreements summed, that is, all the figures with 100% agreement, belonging to the modified MT Beta-86 test and figure with agreement rates under 100% in the same group, were summed. The same was performed with the group of images by Cycowicz et al.[11]. So, the quantity and the percentage of agreements in both figure groups were obtained. Later on, the percentages of groups were compared by the chi-square test, with significance level set at 0.05.

RESULTS

The results of the analysis of figure recognition by Beta MT-86 test follow and allow review of the visual stimuli to initiate the new adaptation of the instrument.

In part A of this study, the Cochrane test was used (significance level at 5%) to identify which of the 266 figures of the test were the most recognized ones by the subjects.

A group of figures stood out for presenting complete agreement (100% agreement). This group was considered as the maximum agreement and was called Group 1.

As mentioned before, levels of agreement under 100% were submitted to the Cochrane test in search for a significant difference, hence formed groups with similar agreement rates. Following this type of analysis, groups of figures with similar recognition rates were formed. Table 1 shows these groups and respective agreement rates and comparisons.

Thus, figures belonging to groups 1 and 2, and nine figures from group 3 were considered suitable for the test, because the percentage of correct responses was above 80%.

The remaining 14 images from group 3, as well as all the figures from groups 4, 5, 6, and 7, were considered unsuitable for the new version of the test, because their rates of recognition was under 80%. These last mentioned groups summed to 38 figures altogether.

Table 2 shows the number of figures that were re-drawn and the number of figures that were maintained with respective percentages. It is observed that 77% of the figures were re-drawn and selected to be analyzed in Part B of this study.

In Part B, the re-drawn figures were used in different tasks. The results of 200 figures that went through a second collection are shown in Table 3.

In total, 168 figures were selected to compose the final version of the tasks for assessment of language skills of the test. These figures selected to compose the modified MT Beta-86 were shown to have an agreement rate of 70% (Table 3).

DISCUSSION

In this study, we sought to empirically verify which visual stimuli of the original and initially adapted to Brazilian Portuguese language Beta MT-86 could be maintained and which of them should be replaced in a version adapted based on their rates of recognition. An analysis of the results obtained in this study is discussed here.

Cognitive skills can be investigated through the use of neuropsychological tests. The first part of our study showed that more than half of the figures (more precisely 53.75% of them) have been recognized and named properly, with an agreement rate higher than 80% (Tables 1 and 2) in the population that participated in this study. It is important to mention that only subjects with high education levels participated in the first part of the study (12 years of study at least).

Studies[4,13-15] have shown that there may be differences between the performance of people with different age groups and schooling in tasks, taking into account that subjects with higher education tend to recognize figures correctly more often, which results in higher agreement and more appropriateness. The rate of 80% of agreement between subjects when recognizing figures appears to be related to the high education profile of the sample.

We also found that, out of 266 figures in black and white (100%), in 123 (46.24%) figures, there was inconsistency in the responses. Naming figures involves visual analysis and recognition, which, in turn, require complex visual representation of an object. The image then generates mental representations in subjects based on their inner knowledge and past experiences.

After this process, the object is represented in our semantic system and, finally, the correct phonological activation takes place[16-19]. The literature reports that the use of figures in black and white for the evaluation of language and memory is common[4,13,14,17,20,21]. These figures must, therefore, be carefully designed, because changes or deviations in drawing can cause difficulties in visual recognition and subsequent failure in naming the figures.

In a previous study conducted with normal and aphasic individuals submitted to the modified MT-86 Beta test, the

Table 1. Rate of agreement in figure naming and comparison

Figure groups	Agreement rate	Number of pictures	Cochrane test	p value
1	100	143	–	–
2	98.3%–90.16	75	0.276	0.023*
3	88.52%–70.49	23	0.062	0.031*
4	68.85%–45.90	12	0.107	0.024*
5	40.98%–21.31	9	0.099	0.031*
6	16.39%–9.83	3	0.554	0.043*
7	1.63	1	–	–
Total		266		

Table 2. Percentage of figures that were re-drawn and maintained

Figures	Maintained	Re-drawn	Total
Number	66	134	200
Percentage	33%	77%	100%

authors pointed that the errors in picture naming could have happened by failure in visual analysis, when the figure did not represent the intended object easily, or a failure in lexical activation[4]. We believe that the stimuli that led to the agreement of responses under 80% may have provided failure in the visual analysis. This hypothesis is reinforced when we consider that there may have been a failure in visual recognition, because a low correlation was also found for individuals with high education levels.

Analyzing each group of figures, one observes that figures that formed the first group, that is, those who achieved a 100% agreement rate, were mainly pictures that represented objects, namely "airplane," ":bed," "television: etc., that is, mostly concrete nouns. We believe that the high rate of correct responses in this group of figures is related to familiarity and the high degree of imageability and concreteness of images. In fact, the figures referred to as the most familiar ones by participants had higher scores, which is in agreement with a previous study[12].

The figures of groups 4, 5, 6, and 7 had low rate of response agreement. They were mostly figures describing actions, such as "the dog follows the woman and the car," "the horse pulls the boy," "the dog follows the boy," among others. The low incidence of responses in agreement figures of groups 4, 5, 6, and 7 may have different causes. One hypothesis is related to the omission of action items, as in the case of Figure number 71, whose stimulus was "the dog follows the woman and the car"; many participants wrote only "the dog follows the woman" and omitted the noun "car."

Furthermore, many naming errors also occurred by mistaking an action for another, as in the case of Figure number 36 ("the boy cries"), which was frequently named as "the boy thinks." In Figure number 123 ("the truck follows the man and the ox"), which had more description errors (60 errors), the low incidence of agreement occurred because most participants named the figure as "the boy and the ox walk in front of the truck."

According to the results obtained and discussed above, the low correlation of responses in certain figures may be due to the amount of stimuli that should have been described in the figures, or to the fact that the drawing does not trigger the same mental representation for all the participants. This type of difficulty can be seen in visual stimuli, so it is often necessary to re-draw the figure and to conduct further studies with different populations and activities of figure naming and recognition; thus, there may be adequacy and increased response agreement.

A study aimed at verifying the naming agreement and familiarity of figures representing objects, animals, and functional activities, among 26 children aged from five to seven years and 24 college students aged from 18 to 25 years, of both sexes, showed that the correlation with the original name was higher than the frequency of other appointments. The children had more difficulty naming figures than the college students. The pictures of objects and animals were considered more familiar to both the groups. In addition to this, the study emphasized the importance of using figures of functional activities in neuropsychological studies[22]. It is, thus, important to maintain figures

Table 3. Response agreement concerning the pictures of the modified MT Beta-86 Test

Task	Response agreement
1. Figures representing words	93.75% of words with agreement rate higher than 70%
2. Figures representing phrases	100% of phrases with agreement rate higher than 70%
3. Written noun naming	100% of stimuli with agreement rate of 70%
4. Naming of semantic classes/hyperonyms	100% of stimuli with agreement rate of 70%
5. Naming of nouns composing semantic classes/hyperonyms	90% of stimuli presenting agreement rate higher than 70%
6. Naming of figures of actions	100% of actions with agreement rate higher than 70%
7. Writing a phrase after the figure	100% of phrases with agreement rate higher than 70%
8. Correspondence between figures and words written	100% of words with agreement rate higher than 70%
9. Correspondence between figures and phrases written	100% of actions with agreement rate higher than 70%

involving actions in the test, because they represent functional activities and are known to be a dissociation of nouns and verbs in cognition and in neural correlates[23]. However, it is believed that the drawings should be standardized so that different appointments do not occur, because these figures are naturally more susceptible to misidentification.

After the concordance of responses in the first part of the study was examined, the figures were replaced based on the analysis of expert judges (three speech therapists, a linguist, and a psychologist), to ensure adequacy to the Brazilian reality and to reduce the chances of difficulty in naming by visual issues. Then the second part of the study was conducted (Part B).

In Part B, visual stimuli related to words and phrases that were considered to be problematic, were replaced following the criterion of proximity to the Brazilian reality. To replace the words, the criteria followed included frequency of lexical and semantic categories, regularity, imageability, extension, operability, and familiarity of stimuli[24].

As the figures were selected based on responses agreement in Part A and the replacements were made, the recognition of figures that would form part of the tasks of understanding and the written naming of figures that would be part of the naming tasks had to be analyzed. It was also necessary to verify the acknowledgement and naming by the population according to different age groups and schooling levels, because the test was intended to be used to diagnose speech disorders in adults of all age groups and education levels. Therefore, concerning the written part, in this phase of the study, we considered spelling errors resulting from low educational level.

The figures that were replaced (77%) and the figures that were maintained (33%) in the modified Beta TM-86 test had a response agreement rate higher than 70% (Tables 2 and 3). This rate was established because in the second part of the study, the sample consisted of different age groups and educational levels; but according to the previous studies[4,13-15], these variables may influence the performances of the subjects.

Because the participants had different schooling levels, this agreement rate was considered adequate and, therefore, further tasks can include more sensitive stimuli aimed at a proper evaluation of mental representations that an aphasic patient may have regardless of the age and schooling. In addition, the 70% rate of agreement resulted in the accounting of possibilities of synonyms in figure naming tasks, i.e., the case of the image of an alligator, which can also be interpreted as that of a crocodile.

Thus, with the second part of the study, we obtained the 168 visual stimuli that composed the final version of the new adapted instrument, which was named the Montreal Toulouse-Language Evaluation – Brazilian version (MTL-Brazil).

Limitations of this study included the difficulty in collective sampling, which hardly allowed exclusion of the participants, the poor filling of questionnaires with high sample loss, and the fact that the large number of figures used for analysis was considered infantilized or poorly drawn; however, there was a gap in the range of figures for stimuli of neuropsychological instruments.

CONCLUSION

In this study, we identified which figures of the modified Beta test MT-86 test can continue to be used in the new version of the instrument, and analyzed the low recognition rate by subjects, which identified the figure groups that were supposed to be replaced and those that remained in the new version of the test.

This study showed two phases of complex adaptation for the modified Beta MT-86 test and described the complexity of this process. Based on our data, researchers and clinicians may use a protocol for language evaluation with stimuli closer to the Brazilian reality.

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