

Development of a Chinese Verbal Fluency Test for the Hong Kong Psychiatric Setting

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Abstract

Verbal fluency assessment is commonly used to evaluate lexical and semantic stores as well as executive functions in patients with schizophrenia and different psychiatric illnesses. Given the considerable involvement of the language element in these types of verbal fluency test, it is likely that direct application of these tests to the Chinese context is not feasible. This is particularly true for the letter fluency test, which requires the participant to generate as many words as possible beginning with letters F, A, and S within 1 minute. The purpose of the present paper is to comment on the development of a new Chinese letter fluency test for local use. Two versions of the test are examined in this paper. The first requires participants to make up a traditional Chinese saying starting with a given word. The second test makes use of homophones: participants are given a single Chinese character and are instructed to give as many of its homophones as possible in 1 minute. It is intended that this review will add clarity to the future direction of studying a fluency test involving phonemic or orthographic cues in the local psychiatric setting.

Key words: *Personality assessment, Schizophrenia*

Introduction

Neurocognitive deficit is well documented in patients with schizophrenia. Numerous reports have demonstrated this by various measures. Executive function, including planning, initiation, and control of goal-directed behaviour is commonly observed to be impaired. Among various measures, a fluency test is one of the most commonly used methods of quantifying cognitive impairment as well as of assessing frontal lobe function. Fluency tests can be broadly classified into verbal and non-verbal fluency tests. Examples of non-verbal fluency tests include the design fluency test¹ and the Ruff figural fluency test.² However, reports of these methods are limited and the test designs are not yet widely accepted. On the other hand, verbal fluency has been extensively studied in patients with schizophrenia³⁻⁹ or other psychiatric illnesses.¹⁰⁻¹³

Verbal fluency tasks require participants to rapidly generate words based on particular criteria. Typically, criteria

can either begin with a specific letter or be a specific semantic category. The former assessment usually refers to the letter fluency test, whereas the latter one refers to the category or semantic fluency test. In the letter fluency test, the participant is given a letter to begin with and uses this to orally generate as many words as possible in 1 minute, mainly using phonemic or orthographic cues. Previously, Benton developed the FAS test involving the letters F, A, and S.¹⁴ Later, a new version called the controlled oral word association test was developed.¹⁵ This later version was based on 2 sets of letters: C, F, and L and P, R, and W. These letters were chosen on the basis of the word difficulty analysis as determined by the number of words present, while for the previous FAS version, letters were randomly selected. Both versions are now widely used by different researchers, and their norms have been documented by large-scale studies.

The semantic fluency test involves the generation of words from certain semantic categories such as animal names, types of transportation, and food. This test requires the use of executive function and the presence of a well-organised category structure that is related to long-term memory.¹⁶ Both semantic fluency and letter fluency have been found to be impaired in patients with schizophrenia.^{4,17} The impairment in semantic fluency is greater than that in letter fluency among patients with schizophrenia.^{4,8,18} Patients with Alzheimer's disease demonstrated disproportionately poorer performance in category fluency than in letter fluency, whereas patients with Huntington's and Parkinson's diseases showed equal impairment in both category fluency and letter fluency tests.¹⁹ It has been suggested that impairment

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of verbal fluency in patients with schizophrenia may be attributable to inefficient access to semantic store,³ reduction in semantic store,⁶ or both.^{5,18} Interpretation of findings in other psychiatric illnesses is relatively straightforward. For instance, impaired performance of verbal fluency in patients with Alzheimer's disease is related to the structure of the semantic store, while that in patients with Huntington's and Parkinson's diseases is due to the problem of accessing the store.¹⁹ Therefore, different cognitive domains may be involved in category or semantic fluency tests and in letter fluency tests.

Moreover, neuroimaging studies also demonstrate that the main area of brain activation is different in these 2 types of tests. The letter fluency test produces more activation in the Broca's and Wernicke's areas, and is mainly dependent on the left prefrontal cortex and left inferior parietal cortex.^{14,18,20-22} In contrast, semantic fluency tasks recruit both the frontal and temporoparietal cortical regions.²¹⁻²³ In addition, studies show that clinically rated thought disorder is associated with, and may result from, semantic processing abnormalities.¹⁷ Patients with more severe thought disorders may have difficulty in assessing semantic items due to a disorganised semantic system.

Given the significant involvement of the language element in these types of verbal fluency test, it is likely that direct application of these tests to the Chinese context is not feasible. The semantic or category fluency test is more commonly used worldwide because it can be translated into different languages and the results are comparable. Previous studies recruiting Chinese participants tended to focus on the performance of category fluency in different psychiatric illnesses and healthy populations.^{12,24-27} For the letter fluency test, however, relatively few studies have been conducted in Chinese people. This may be because the direct applicability of the letter fluency test to the local clinical settings is limited, especially for elderly patients or those with a poor educational level.

The purpose of this review is to comment on the applicability of a verbal fluency test to the local psychiatric setting, with particular emphasis on the need to develop a comparable Chinese letter fluency test for local use. It is not our intention to provide an exhaustive literature review on the topic — a search of the literature does not show any studies of a comparable letter fluency test for Chinese. Although we do not include any data in the present paper, we do hope that the discussion will add clarity to the future direction of studying fluency tests that involve phonemic or orthographic cues in a local psychiatric setting. Although this issue might initially appear to be of academic and clinical interest to a wider range of psychiatric illnesses, we have narrowed it down to the population with schizophrenia. Patients with schizophrenia are commonly documented as having impairments in speech production, semantic system, and a wide range of neurocognitive function deficits. Therefore, in the following part of the discussion, the focus is mainly on the use of verbal fluency as a cognitive measure in patients with schizophrenia.

Cognitive Mechanism: Impaired Verbal Fluency

As mentioned, both semantic and letter fluency are affected in patients with schizophrenia. Currently, schizophrenia is diagnosed by a syndromal classification that encompasses a wide-ranging and heterogeneous group of illnesses. Neurocognitive tests such as the verbal fluency test may be able to serve as a basis for subtyping and may provide a more objective measure for assessing these patients. Furthermore, it has been suggested that verbal fluency deficit can be considered as a familial trait marker for schizophrenia.⁷ This marker allows identification of a non-psychotic individual in the family who is prone to develop schizophrenia. Different types of fluency tests may also help to determine the underlying cognitive mechanism in thought disorder and possibly offer a better explanation to the observed phenomenon. In a study by Goldberg et al, a score for the difference between semantic and letter fluency tests is found to be associated with severity of thought disorder.¹⁷ This score may be able to control for retrieval factors, attentional and motivational factors, and general cognitive deficit common to both tasks, thus giving us a more objective measure of the cognitive status. However, further studies are necessary to assess the validity and reliability of this measure.

Language problems are commonly observed in patients with schizophrenia. There can be linguistic and semantic aspects. In previous studies, both impairment in letter fluency and semantic fluency tasks have been documented. Different researchers have used different models to explain this deficit. One of the areas of discussion is whether the poor verbal fluency in patients with schizophrenia represents degradation in semantic store or inefficient access to normal semantic store. Joyce et al tried to solve this problem by using a cueing technique when using the category fluency test.⁴ Cues such as 'animal found on a farm' were employed and showed that category fluency improved for the majority of patients with schizophrenia when this technique was used. This finding is similar to those for patients with disorders of frontostriatal systems such as Parkinson's and Huntington's diseases. Thus, Joyce et al suggested that the poor verbal fluency performance of patients with schizophrenia is due to inefficient access to semantic store.⁴ It was also suggested that the deficit is due to inferior general intelligence, because these researchers tried to predict the fluency score from the estimated IQ score, and the performance of the patients with schizophrenia was significantly worse than predicted while the performance was similar for healthy controls.

Allen et al tested this hypothesis by examining the problem from another viewpoint.³ These researchers examined the consistency of performance in semantic fluency across trials. Twenty patients with schizophrenia were recruited and compared with 9 control patients with depression and 10 healthy controls. It was demonstrated that patients with schizophrenia produced fewer words but

the words were more variable across trials. These researchers concluded that the estimated word pool for patients with schizophrenia was similar to that for healthy controls, suggesting that the impaired semantic fluency performance was largely due to a problem with access to semantic store rather than a storage problem.

Another problem that could lead to poor category fluency performance is the over-inclusiveness in categorisation, which is proposed to be one of the descriptions of schizophrenic thinking. It has been hypothesised that patients with schizophrenia may have a disorganised semantic network resulting in a shift in the semantic boundaries.^{28,29} However, this area is controversial because evidence is not coherent across different centres. Other researchers have debated that patients with schizophrenia have intact decision-making skills, although they are disorganised in language.⁹

In summary, the current evidence provides 2 main hypotheses for this issue. Firstly, there is an anomaly in organisation of semantic store found in patients with schizophrenia. Secondly, the retrieval mechanism such as priming may be impaired, causing poor verbal fluency performance despite the store being intact. Both hypotheses are possible and are a sound explanation, although recent evidence is inclined toward the latter hypothesis.

The New Chinese Letter Fluency Test

Previously, semantic fluency has played an important role in assessing neurocognitive deficits, with the studies of patients with schizophrenia providing a good example.^{3-6,9} Neurocognitive deficit is commonly observed and is proposed to be independent of cultural background.³⁰ This concept is important in the context of research in Hong Kong, where the semantic fluency test is the sole tool used in the study of verbal fluency. Recent studies of the letter fluency test have suggested that it has a unique role in cognitive study, since it is assessing a different aspect of cognition than the semantic fluency test. Goldberg et al suggest that the parallel use of these 2 different tests may minimise the effect of other confounding factors.¹⁷ These studies indicate a need to develop a similar tool such as the letter fluency test for use in the local setting to facilitate future research in this area.

However, the western version of the letter fluency test is difficult to adapt for the local population. If an equivalent test is to be developed, it must resemble a similar phonological loop as in the letter test. However, it is technically difficult to construct a similar version due to the large difference in the basic language structure between Chinese and English. The development of a new Chinese version of the phonological fluency test resembling that of the letter fluency test in English is therefore highly recommended.

The main focus of this test is to examine the phonological loop of lexical access. Two versions of the test are examined in this paper. The first one requires participants to make up a traditional Chinese saying starting with a given word. They are given 1 minute for each character

and are instructed to give as many examples as possible. Three characters would be given — these are chosen as an initial assessment of the test and their difficulty level is not matched. Names and nouns are not accepted and are counted as incorrect in the interpretation, e.g., ‘一山還有一山高’; ‘一人計短，二人計長’; ‘三五成群，三分四裂’; ‘五世其昌，五福臨門’. The number of repetitions is also noted. In this test, participants are expected to make use of the phonological loop to search for the correct saying that begins with a specific morpheme. This minimises retrieval by the sayings’ semantic meaning, which is the usual path in everyday conversation.

Although this test attempts to simulate the mechanism of the letter fluency test in English, there are 2 major drawbacks. Firstly, the given Chinese character may still serve as a semantic hint to the participant since the character itself carries a specific meaning. Secondly, it is suggested that Chinese characters convey a higher degree of orthographic information compared with English letters. There is evidence to suggest that the phonological cue is less useful for lexical access when reading Chinese than with English.³¹ Orthographic activation plays a major role in understanding when people read Chinese. This indirect evidence may be unfavourable to the current test design. Chinese tends to involve more visual spatial memory than English letters despite the lack of visual stimulation in the test design. Although visual spatial memory is affected to a lesser extent in forming a compound word or saying than in forming a single character, it remains a potential threat to the test design that should not be underestimated.

The second test in trial is the use of homophones. Participants are given a single Chinese character and are instructed to give as many of its homophones as possible in 1 minute. Participants need to mention a compound word or phrase to indicate the exact homophones. Again, 3 different characters are used, which have been chosen for their popularity and their large pool of homophones. To avoid retrieval via the orthographic route, characters that share a similar base unit are counted as repetition. This eliminates the search through the visual spatial memory during the retrieval and since other homophones usually differ significantly in shape and construction, it is a prudent assumption that this task predominantly activates the phonological loop during the retrieval. For example, the word ‘色’ could be accompanied with other words with similar pronunciation such as ‘式’, ‘拭’, ‘識’, ‘息’, ‘悉’, ‘蟋’, ‘釋’, ‘骰’, ‘飾’, ‘適’, ‘謫’, ‘析’, ‘惜’, and ‘齋’. Similarly, the word ‘絲’ may be accompanied by ‘詩’, ‘司’, ‘私’, ‘斯’, ‘撕’, ‘師’, ‘獅’, ‘施’, ‘屍’, ‘思’, ‘俚’, and ‘鯉’.

Although this test is closer to the letter fluency test, it has a major shortcoming in that the number of homophones for a single character in common use is very limited. Moreover, similarity in pronunciation and the fact that the same character may have different pronunciations may cause confusion during the interpretation. Therefore, caution should be taken in validating the test.

Conclusions

In this review, 2 newly developed tests that are comparable to the traditional FAS letter fluency test for local practice are described. The main focus of these tests is to examine the phonological loop of lexical access. The first one requires participants to make up a traditional Chinese saying starting with a given word. The second test makes use of homophones. Participants are given a single Chinese character and are instructed to give as many of its homophones as possible in 1 minute. Despite the differences in design, both tests share a common problem in verbal fluency task, in that the verbal intelligence exerts a significant effect on the participant's performance. Thus, it is essential to control this confounding factor by estimating the participant's verbal intelligence during the study. A study is now underway to test these hypotheses and it is hoped that this discussion will add clarity to the issue of the future direction of studying fluency tests involving phonemic or orthographic cues in the local psychiatric setting. It is hoped that we can provide more empirical data on the local norms and clinical profile for patients with various phases of psychosis in the near future.

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