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Research Article

Bouba/Kiki Test for Patients with Behavioral and Psychological Symptoms of Dementia

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Abstract

We wondered whether both favorable and serious emotional sensitivities can exist simultaneously in patients with high Behavioral and Psychological Symptoms Of Dementia (BPSD) or not. We examined Bouba/Kiki test in patients with BPSD in a psychiatric dementia hospital. Thirty-one of the 39 could answer this question appropriately, even those with high BPSD and impaired cognitive function. We found that Bouba/Kiki responses were not degraded with decreased cognitive function nor increase of BPSD. Since serious and favorable emotions might exist as an entangled mixture in patients with dementia, the primary purpose of care of BPSD should not be to depress NPI using antipsychotics, but rather to increase favorable emotions without antipsychotics. We viewed the mystery of entanglement of emotions through an analogy to and potential lessons from quantum mechanics. Any measurement or interaction with any system, be it quantum states, or human beings, necessarily changes the system observables or the emotional QOL of real people, for better or ill. We should pay attention to this in care-giving to patients with BPSD, leading them to enlightenment and delightful aging.

Keywords: BPSD; Cognitive function; Delightful aging; Emotional function; Quantum mechanics analogy and lessons

Introduction

In dementia patients likes and dislikes may change from time to time, and they are often clearly expressed without being restricted by the declining cognitive functions. Unlike healthy people, the emotional function of dementia patients is relatively easy to score, such as serious emotions with the Neuropsychiatric Inventory (NPI) [1] and favorable emotions being measured with the Delightful Emotional Index (DEI) [2]. Patients with high Behavioral and Psychological Symptoms of Dementia (BPSD) usually express anger, sorrow, violence but little joy and happiness. We wondered whether patients with high BPSD have favorable emotional sensitivities as well as serious negative sensitivities or not. It has not been reported whether opposing sensitivities exist simultaneously in patients with high BPSD. Here we address this issue. Furthermore, mechanisms of expressions of either serious or favorable emotions have not been well characterized. The Bouba/Kiki test [3] was developed to explore the influence of visual information on language processing. This test is a visual lexical decision task with the sharp-sounding and soft-sounding verbal stimuli presented within the spiky and curvy frames. It has been reported that in healthy persons about 95 to 98 % subjects answer appropriately to the Bouba/Kiki test, which suggests that both serious and favorable emotions may be sensitive simultaneously. We specifically wondered whether opposing emotional sensitivities can exist simultaneously in patients with BPSD or with high NPI scores. In the present study, we examined the Bouba/Kiki test in patients with high BPSD in a psychiatric dementia hospital and viewed potential mechanisms of explaining these sensitivities through the lens of and analogies to Quantum Mechanics (QM).

Materials and Methods

We showed dementia patients jagged shapes versus soft cloud-like shapes and asked, “Which shape corresponds to the names Kiki or Bouba [3]?”. Among 48 inpatients in Sendai Tomizawa Hospital, a psychiatric dementia hospital, 9 patients were excluded due to comorbidities (1 schizophrenia, 2 end stage of dementia, 3 difficult of hearing and 3 declining to participate). Finally, 39 patients with Alzheimer’s disease, vascular dementia, or Lewy body disease were included in the analysis. Over the period from April 2025 to August 2025, studies including the Mini-Mental State Examination (MMSE, 0-30) [4], NPI (0-144), and Barthel Index (0-100) [5] were cross sectionally performed in the morning. Answers for both round and spike shapes were all or nothing and appropriate answer means a correct answer for both shapes. Reproducibility was confirmed in all patients and they answered correctly and quickly once they understand the situation. All measurements were scored by a trained nurse who was blinded to treatment status. Written informed consent in this study was obtained from patients or their guardians.

Results

Thirty-one of the 39 could answer this dichotomous question appropriately, even those with high BPSD (NPI =21±5, mean ±SD) and impaired cognitive function (MMSE =10±5, mean ±SD). The cumulative probability of this is $p \le \sum_{k=0}^{8} 2^{-39} \binom{39}{k} = 3.5 \times 10^{-5}$, where $\binom{39}{k}$ is the binomial coefficient. Five covariates (sex, age, Barthel Index, MMSE, and NPI) were used for the multivariate regression analysis (Rcmdr Plugin. EZR, Japan) with each item as an explanatory variable and the positive or negative response to Bouba/Kiki test as an objective variable. All items showed no significant correlations (Table 1).

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Covariate	Raw numbers or values (mean±SD)	PRC	P-value	OR	95%CI
Sex, f/m	25/14	-0.8	0.49	0.45	0.04-4.48
Age, years	83±6	-0.12	0.29	0.88	0.69-1.11
Barthel Index for activities of daily living	49±26	0.02	0.41	1.03	0.96-1.09
Mini Mental State Examination (MMSE)	10±5	0.44	0.06	1.56	0.98-2.48
Neuropsychiatric Index (NPI) for BPSD	21±5	-0.07	0.47	0.93	0.76-1.14

Table 1: Multivariate Logistic regeression analysis of Bouba/Kiki test (appropriate answer 31/ inppropriate answer 8).

The 5 covariates were used for the multivariate regression analysis (Rcmdr Plugin. EZR, Japan Significance was considered at P<0.05.

Abbreviations: PRC, partial regression coefficient; OR, Odd's ratio: CI, cofidenence interval; BPSD, behavioral and psychological symptoms of dementia.

Discussion

We found that Bouba/Kiki responses were not degraded with decreased cognitive function nor increase of BPSD. These significant results suggest that opposing emotional sensitivities can exist simultaneously, and that if they are exposed to a Kiki environment, distressed emotions prevail, whereas by contrast, if they are frequently exposed to a Bouba environment, happy emotions emerge. If only serious sensitivity but little favorable sensitivity were present in patients with BPSD, one target would be to decrease NPI, and antipsychotics could be prescribed in patients with BPSD [6]. BPSD sometimes mimic those of delusions in schizophrenia but since serious and favorable emotions might exist as an entangled mixture in patients with dementia as shown in the present study, the primary purpose of care of BPSD should not be to depress NPI using antipsychotics [7], but rather to increase favorable emotions without antipsychotics. Antipsychotics should be avoided as much as possible, because while reducing BPSD, they also reduce otherwise reversible favorable emotions [2]. Since BPSD is a state in which distressing emotions are expressed or manifested, we suggest that by repeatedly inducing favorable emotions, BPSD will gradually decrease and the patient will be able to express favorable emotions [8,9]. Most geriatric patients suffer from psychological symptoms such as loneliness, multi-organ impairment, fear of death, etc. The real purpose of geriatric patient care, including especially those with BPSD is to create an environment that brings them feelings of joy and delightful aging, leading them to enlightenment.

We viewed the mystery of simultaneous opposing emotional sensitivities over a wide variety of senses from negative to positive. We then were led to consider this entanglement probabilistically, through an analogy to and potential lessons from Quantum Mechanics (QM) as follows. One of the many ways to interpret the mystery of the brain has been suggested to be QM [10]. The brain has both cognitive and emotional functions, respectively centered in the neocortex and the limbic system. These have distinct and different properties. Cognitive functions can be objectively measured, and classical mechanics often give a clear picture of causal relationships. These in turn may inform clinical decisions about appropriate therapies. Importantly, there is little ambiguity about the meaning of such measurable quantities.

By contrast, emotional functions span a very wide range, from negative anger and sorrow to positive joy and happiness with a variety of gradations. These are, even in principle, difficult to measure, in large part because this vast spectrum of emotions can be present as mixtures; they can simultaneously co-exist in any individual as shown in the present study. Such a mixture may itself evolve over time, from hours to days or longer. Because of the ambiguity and fluidity in these mixtures, which we may call "entanglements", they can therefore manifest in correspondingly different behaviors, including BPSD.

In classical mechanics, various properties of a system can be accurately and unambiguously measured with Newtonian physics. But following the early 20thc, we now appreciate that the world is really a quantum world [11]. While it is true that QM has elucidated much about the atomic/molecular basis of neural transmitters, we do not wish to engage here in a debate whether brain function can be "explained" by QM, but rather to draw parallels and lessons. In the quantum world, classical physical properties like energy, linear and angular momenta, etc. are replaced by operators on functions or "phase-waves" [12]. The solutions to atomic and molecular systems are given by superpositions of these states. Measurable quantities arise from summing over these phase-waves (including state amplitudes and phases), which can become entangled, chaotic, and constructive or destructive. For example, the states may spread out, leading to a wave-like picture; if the states bunch spatially, a particle-like picture may emerge.

What then are the links or analogies between these two pictures, each of which has a potentially complex mixture of states? And what can we learn to inform care for patients with BPSD? The QM particle picture is (partially) analogous to the cognitive dimension in dementia, wherein little is ambiguous, and much can be measured. By contrast, the QM wave picture is one of probabilities of the result of a particular superposition of states, and is analogous to the multiple emotional (or limbic) entangled dimensions of the evolving behavioral manifestations. This raises the question of what neural network superpositions might mark particular manifestations of BPSD. Negative emotional ones may follow patterns of behaviors like greed, self-promotion or vanity in society, to exaggerate, even to belittle others. By contrast, positive emotions can arise in a home or hospital atmosphere which is supportive and has a focus on promoting these healthy emotions.

We suggest the similarities between quantum mechanical particle/wave duality and the brain's cognitive/emotional duality to be striking. Both depend on superpositions of states. These superpositions in the non-relativistic quantum world are relatively straightforward. But in the brain, the superpositions depend on the underlying neural networks. We suggest that while much is known at the cognitive level, the neural networks controlling emotional function are much less well understood, and in consequence may exhibit a range of manifestation, some unstable and erratic. Advancement of technology without control of emotional function can lead to disastrous consequences such as nuclear or biological weapons, a lack of safe encryption of sensitive data, including confidentiality of patient information, etc. Indeed, attention to emotional function is more important than cognitive functions in daily life and social activities.

This is directly analogous to the pioneering work of Heisenberg, and his Uncertainty Principle [13]. A consequence of this is that a measurement or an altered environment necessarily changes the underlying system (e.g., in QM, measuring a particle's position disturbs its momentum in reciprocal magnitude). This is analogous to the fact that the emotions displayed by BPSD patients can swing to distressed emotions if they feel uncomfortable, or to happy emotions in a supportive environment. When a BPSD patient is greeted in a superficial, one-off examination, versus when they are approached by a care-giver with sincere empathy and compassion, the patient senses this distinction and responds accordingly. This is a phenomenon in which dementia patients can switch the superpositions of states from net negative to net positive, even jubilant emotions, through affective therapy involving goodness.

There are some direct consequences for care-givers, which closely parallel Heisenberg [13] and our analogies and lessons from QM. On the negative side, when a caregiver approaches a patient with an atmosphere of distress, that is, with the vibrations of distressing emotions, the patient senses this, has distressing emotions and begins to think negatively of the past and future. On the positive side, by contrast, when the caregiver approaches the patient with favorable vibes, the past and the future feel favorable. No matter how serious the past may have been, if the patient is approached with favorable emotions, the probability of the patient being enveloped in favorable emotions regardless of the past events increases. These are very close to Heisenberg [13] and our analogies and lessons from him in QM.

Conclusion

The present result suggests that opposing emotional sensitivities exist simultaneously in patients with decreased cognitive function nor increase of BPSD, and that if they are exposed to a Kiki environment, distressed emotions prevail, whereas if they are frequently exposed to a Bouba environment, happy emotions emerge. BPSD in dementia is a state in which distressing emotions are expressed, we suggest that by repeatedly inducing favorable emotions, BPSD will gradually decrease and the patient will be able to express favorable emotions.

This study was approved by the ethics committee of Yamagata Kosei Hospital, in partnership with Sendai Tomizawa Hospital (2019-3).

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Conflict of Interest

The authors declare no conflict of interest.

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None.

Author's Contribution

All authors satisfy the four criteria for authorship based on the ICMJE recommendations, section 2: conception, analysis, interpretation; drafting for intellectual content; final approval; accountability.

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