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TeleCog: A Technological Advancement in the Future of Cognitive Assessments

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***Abstract*—The purpose of this paper is to interpret how dementia affects the brain, and how cognitive assessments are out dated with the way technology is advancing. Examining multiple pen and paper cognitive assessments helped researchers potentially come up with a solution that could bring cognitive assessments up to speed with technology, and assist in the diagnosis of dementia process. TeleCog, a digitized cognitive assessment, was distributed to healthy individuals to test the effectiveness of the examination. Researchers were able to conclude that TeleCog can be used to assist in detecting dementia if given the right modifications on the examination.**

***Index Terms*—Aging, Alzheimer, Brain Damage, CASI, Cognition, Cognitive Abilities, Cognitive Impairment Dementia, Dementia, EQAC, Lesions, Lewy Body, MMSE, and Technology.**

I. Introduction

The rapid increase in the elderly population in the United States has created a greater need for better healthcare options. Dementia cases in particular has been steadily going up in older individuals [1]. A third of all people with dementia live alone [1]. This poses a threat to their health due to the fact that the only time their needs are met is if there is a medical emergency or another type of medical crisis. There are many other barriers, day to day that these people have to deal with. Deteriorating symptoms include apathy and impaired decision-making skills which bar the person inflicted from seeking help on their own. Without supervision, there is no one to witness the changing moods and conditions of these individuals. Home based care is one of the best ways to help people with dementia [5]. Dementia, a group of brain disorders that generally results in memory loss, poor cognitive function and even poor judgement. Health care costs for this disorder are massive as it most likely causes morbidity in those suffering and those who are caring for someone who is afflicted with this disorder. With the cost of treating this disorder being so high, it is essential that the diagnosis be done efficiently.

Dementia alone is not a single disease, it constitutes of a multitude of symptoms and diseases of memory decline and was previously used to describe those who are "senile". This is an incorrect stigma that perpetrates the idea that mental decline is a natural aspect of the aging process. Dementia is typically seen as a more "severe" form of Alzheimer's disease but in fact Alzheimer's disease is just one of the many diseases that constitute dementia [6].

There have been many previous established measures that aid in the diagnosis of dementia. The Folstein Mini-Mental State Examination (MMSE), is one of the foundational scales used to diagnose dementia in a large and diverse group of individuals [2]. There have been other scales that took inspiration from the MMSE like Cognitive Abilities Screening Instrument (CASI) and the Elderly Cognitive Assessment Questionnaire (ECAQ) both try to diagnose the disorder in a timely and efficient manner [3, 4].

The common thread of these scales is that they are all paper based questionnaires. The questionnaire method of surveying patients is not necessarily an outdated one, but for patients with dementia, the necessity for a direct interaction between patient and clinician may prove to be too much for patients outside their comfort zone. With either the patient or clinician needing to adjust to the other's schedule or personality, the feasibility of successfully utilizing these paper questionnaires goes down. So the common thread that these questionnaires shared now become a common weakness. But what if the patient and clinician never need to meet consistently? Or even at all? This paper will discuss a new way to administer the diagnosis of dementia, one that eliminates the need of face-to-face interaction. (Insert whatever the app name is here), is a revolutionary new technological cognitive application that enables patients to be diagnosed at their own leisure and comfort.

II. Dementia and the brain

Dementia affects the most important organ in the body – the brain. Dementia is a term used for classifying symptoms relating to a loss of brain function. These symptoms can include, but are not limited to: memory loss, personality changes, loss of social skills, language problems, behavior problems, loss of emotion, and the difficulty or inability to solve problems or complete tasks that previously have been easily completed. Dementia can be categorized into levels of severity. The mildest stage of dementia is when it just starts to affect a person's ability to function normally, while the most sever stage is when the person must completely depend on others in order to complete basic tasks required for daily life [11].

At the basic level of information processing of the brain, we move the cellular level. The brain is made up of special cells called neurons [8]. There are all different types of this cell. An important one is called a sensory neuron, which transmits information from the sensors of the body (eyes, ears, nose, etc.) that detect external stimuli [8]. Another function this type of neuron performs is detecting internal conditions, for example blood pressure and muscle tension. These pieces of information are sent to the ganglia, or the brain's processing center, to be interpreted and analyzed [8]. Once this process is done, a person will be able to understand what is happening to them, e.g. a muscle cramp because it has been kept in one position too long, a friend pokes the person and they turn around in response to the stimulus, the heart beat rate increases because the person has stepped on black ice and almost fell, etc. Communication between cells is crucial, and there is a number of different ways that cells can "speak" to one another. A neurotransmitter is one of the ways that neurons can communicate with each other. A neurotransmitter involves using chemicals as information for the cell to do something. A common neurotransmitter is acetylcholine, which is vital for the nervous system functions that involve memory formation and learning [8].

A. Causes of Dementia

There are many causes of dementia. Changes in the brain that can contribute to the onset of dementia are Lewy body dementia and vascular dementia. Lewy body dementia is a type of dementia that worsens over time [11]. Specific symptoms of Lewy body dementia are: fluctuations in alertness, hallucinations, slowness of movement, trouble walking, mood changes, depression, and rigidity [11]. Although the cause for the onset of Lewy body dementia is unknown, the mechanism behind it is clear. Lewy body dementia is the result of a buildup of Lewy bodies – clumps of protein – in neurons, and is classified as a neurodegenerative disorder. There is no cure for dementia with Lewy bodies. Vascular dementia is caused by problems regarding the supply of blood to the brain. Vascular dementia typically starts with a series of minor strokes that lead to a decline in cognitive function over time [11]. Since the blood supply to the brain is not as efficient as it should be, it causes the brain to develop lesions in the brain and can also result in changes of brain structure. Other conditions that can cause memory loss are prescribed medication side effects, chronic alcoholism, brain tumors or infections, blood clots, vitamin B12 deficiency, several thyroid, kidney, or liver disorders, or stroke. Some of these conditions are treatable and are sometimes reversible. Several diseases such as Huntington's disease, Parkinson's disease, Multiple Sclerosis, Lyme disease, and HIV/AIDS can also cause dementia [11].

B. Dementia and Brain Structure/Activity

The structure of the brain is directly affected by dementia. It was found that in a study done by Christina Solé-Padullés et al, MRI scans showed that healthy elders had larger brains by volume that exhibited a higher cognitive reserve than elders that had early forms of Alzheimer's disease. Elders that had higher cognitive reserve that exhibited signs of dementia or early Alzheimer's had smaller brains by volume. This means that the brains that were affected by early forms of Alzheimer's or dementia were able to cope with damage to the brain caused by early Alzheimer's diseases or dementia [10].

C. Dementia and Learning

Lesions in the brain are directly related to dementia [7]. In a study conducted by the Institute of Psychiatry of De Crespigny Park in London, 48 patients with frontal or non- frontal cortical lesions were given a go – no go learning task. Patients with lesions ultimately took longer to learn the task, made more false "go" responses, and also took longer to make these false "go" responses [7]. This study showed that patients with lesions in the frontal lobe in either hemisphere of the brain, commonly caused by dementia, can cause slower learning abilities in regards to go – no go learning tasks [7]. The ability to pay attention to a stimulus also deteriorates in patients with dementia [9]. Without the ability to stay focused, it is near impossible to learn. There are several well-known cognitive assessments that are able to track a subject's mental abilities.

D. The Stages of Dementia

Diagnosis	Stage	Signs and Symptoms
No Dementia	Stage 1: No Cognitive Decline	Normal functioning, no memory loss, mentally healthy
No Dementia	Stage 2: Very Mild Cognitive Decline	Normal forgetfulness associated with aging such as names or where familiar objects were left
No Dementia	Stage 3: Mild Cognitive Decline	Increased forgetfulness, slight difficulty concentrating, decreased work performance, difficulty finding right words, gets lost more often, usually 7 years before onset of dementia
Early-Stage	Stage 4: Moderate Cognitive Decline	Difficulty concentrating, decreased memory of recent events, trouble managing finances or traveling alone to new locations, in denial about their own symptoms, social withdrawal, detectable by a physician
Mid-Stage	Stage 5: Moderately Severe Cognitive Decline	Major memory deficiencies, need assistance to complete daily activities, difficulty remembering major aspects of current life such as their address, phone number, may not know
		time, day, or their current location
Mid-Stage	Stage 6: Severe Cognitive Decline (Middle Dementia)	Require extensive assistance to carry out daily activities, forget names of close family members, little memories of recent events,
Late-Stage	Stage 7: Very Severe Cognitive Decline (Late Dementia	No ability to speak or communicate, require assistance with most activities, often lose psychomotor skills such as the ability to walk

Fig. 1. The Multiple Stages of Dementia also known as the Reisberg Scale

III. Current Cognitive Assessments

Cognitive assessments are used and administered to determine a persons' level of cognitive ability. Ranging from clinical exams, medical history, assessments of multiple cognitive domains, lab tests, or even MRI / CT scans - the level of cognitive ability can be measured and can assist in the detection or diagnosis of cognitive impairment, such as dementia [12]. Dementia affects 2.4 to 5.5 million Americans, with its prevalence increasing with age [12]. Nonetheless, such signs and symptoms of cognitive impairment may include the quality of life, cognition, mood, and even behavioral deprecation [12]. A 2014 study reported by Mansbach, MacDougall, Clark, and Mace [13] examined the use of the Kitchen Picture Test (KPT) as a screening measure for the assessment of cognitive impairment and practical judgement in older adults [13]. According to Mansbach et al., the Kitchen Picture Test depicts a scene in which a young woman is distracted by a telephone conversation, and is made unaware of the dangerous events unfolding around her [13]. Therefore, it is up to the participants to identify the three problem situations in terms of dangerousness, interventions, and the situation itself [13]. Each type of identification that was made by participants was scored individually and was ensured to reflect cognitive impairment, as opposed to visual deficits [13]. The notion that cognitive impairment takes into account not only a persons' cognitive ability, but also their quality of life and capability to make certain judgements, is what affects the

individual from acquiring the cognitive functions that had once been evidently present.

Several of the cognitive assessments that have been used to diagnose and measure dementia include (but are not limited to) MMSE [14], Clock Drawing Test, verbal fluency tests, Informant Questionnaire on Cognitive Decline in the Elderly, the General Practitioner Assessment of Cognition (GPCOG) [15], Memory Impairment Screen, Mini-Cog Test, Abbreviated Mental Test, Short Portable Mental Status Questionnaire, and even the Montreal Cognitive Assessment (MOCA) [12]. It has been found that the General Practitioner Assessment of Cognition (GPCOG) [15] has a higher sensitivity than the MMSE [14] when looking at published cut points. Both are equally efficient at detecting dementia. The importance of detecting dementia at a primary care level, is that the earlier that the signs are noticed, the better [14]. Knowing about whether a patient has dementia and where it started, gives the physician a whole picture view that can help further treat patients in the long run. The GPCOG was developed to be quick and easy. It consists of two parts, the first is a short cognitive test which takes about 4 min and the second is an informant interview, about 2 minutes, making the total test for the GPCOG a total of about 4-6 minutes [15]. Having a shorter time frame is crucial, if primary care physicians are going to integrate the use of this test in their normal checkups. The use of this assessment also has other positive points. The test is certified to test in 14 different languages and has an additional advantage of not being biased based on education, sex, or physical health of participants [15].

GPCOG consists of two sections [15]. The initial section is a cognitive assessment that uses time orientation, clock drawing, reporting a recent event and recall of a five-part name and address [15]. Each of these components is assigned a point value and if the patient scores less than a 5, then it indicates a cognitive impairment and scores more than 8 indicate that cognitive impairment is unlikely [15]. If a patient gets a score between 5 and 8 then they are considered ambiguous and must move on to the second portion which is a brief interview that is scored out of six [15]. The patient is tested on information on recent events, recent conversations, use of language, ability to manage personal finances, ability to manage medicine intake, and the ability to use transportation [15]. If the patient is not able to answer these six questions in the interview, then points will be added to their score total [15]. The higher the points, the higher chance that there is some cognitive impairment. When these two sections are combined, the point total becomes 15 [15]. The cut point is 10/11 [15]. This score shows that there is likely cognitive impairments. Compared to other tests, the GPCOG has the smallest point system, it is really easy to use, and is quick.

The MMSE [14] tends to have a lower sensitivity than the General Practitioner Assessment of Cognition (GPCOG) [15], but nonetheless, can also be seen as a cognitive assessment used to detect dementia. MMSE has been validated through a study whose purpose is to test the accuracy of the MMSE [16]. It was found that it was conclusive with the range that they set for themselves: no cognitive impairment (normal), questionable cognitive impairment, mild cognitive impairment, moderate cognitive impairment and severe cognitive impairment [16]. Using a simple staging model, it was found that the MMSE was indeed valid.

Subsequently, as valid and reliable as such assessments may be, some of these tests run the risk of being outdated. Technology has taken a toll on not only the advancement of the medical and research field (as well as other fields), but has also set out an advantage of being able to fulfill and assess a cognitive impairment, such as dementia, without the presence of a medical physician. Essentially, by creating an advanced assessment that can be compatible with any mobile, laptop, or tablet device - the persons' level of cognitive ability is measured through the organized assessment at any given time or place. The reinvention of cognitive assessments - moving forward into the 21st century with new technological resources - is presented with the use of various cognitive domains in the form of Qualtrics.

IV. Case Study

Researchers wanted to assess early detection of dementia by incorporating previous cognitive assessments and measurements that could be used to determine an individuals' level of cognitive ability. Qualtrics was utilized as the foundational tool for creating an interactive assessment that would not only have test takers engaged - but also test the different functionalities of the brain. In an attempt to transition traditional pen and paper examinations to a technical platform, Researchers in conjunction with a Psychiatrist and Occupational Therapist created TeleCog. TeleCog, a digitized study founded on the basis of detecting dementia in individuals, was formatted into three segments: Confidence Boosting, Testing and Finale. Confidence Boosting was geared to have the individual begin the exam with a sense of certainty and clarity that the assessment would not lose their attention but rather draw them in with simplistic questions. The Testing section takes the simplistic ideas and begins to expand on the theory of cognitive functionality; building on the difficulty, and beginning to test the brain functionality of the individual with

matching, rearrangement and remembrance. The Testing section is the most important piece in the motive of testing the ability the individual has to think. Cognitive functionality is stressed in the Testing phase of the exam in order to bring a scientific element to the digitized study. Researchers 'intentions for the conclusion of the exam was geared towards the hope of keeping participants feeling positive and not disgruntled after finishing the assessment. The initial format was created on its own basis, and steered away from pen and paper assessments. The goal of the format was to add a unique element to the exam that had not been issued, in order to give TeleCog its own sense of feel and distribution.

Researchers incorporated previous cognitive assessments such as, MOCA [12], GPCOG Screening Test [15], SLUMS [17], and MMSE [14]. Qualtrics was used as the base to assist in the formatting of the digitized assessment. In addition, each analytical element was created by observing previous studies that focused on different areas to examine cognitive impairment. MOCA [12] had introduced pictorial aspects that tested each participants' capability on recognition and association (listing objects in a particular order), while the GPCOG Screening Test [15] focused on distributing and collecting straightforward information that the participant was able to provide (Name, Address, Month, etc.). In addition, several other cognitive elements that were measured and observed throughout this study, were memorization and mathematical application. Following the basis of examination from SLUMS, an assessment used for detecting mild cognitive impairment and dementia, researchers were able to incorporate a basic mathematical principle that had participants calculate the total amount of two numerical components [17]. Subsequently, memorization was also introduced as a component from a previous examination known as the MMSE [15] - in which, researchers assigned specific words for participants' to remember and then recall by the end of the assessment. Branching off of previous cognitive assessments, experimenters were able to introduce a new technological aspect to the original Qualtrics evaluation, by introducing the drag and drop element, as well as the rearranging element. The purpose of introducing technological features to TeleCog that were not on prior examinations, was to solidify a unique aspect of the exam that has not been incorporated before. TeleCog introduces the physicality of being able to use these specific features on any device and anywhere in the world. After the creation of the exam, TeleCog was distributed to individuals locally and results were examined.

V. FINDINGS

Researchers were able to distribute the assessment to 30 individuals whose age range was from 17-69. Test subjects were able to complete the examination in an average time of five minutes, which was the average time we had predicted. The range for the examination time was from 2min. 23secs. – 11min. 22secs. Based on these facts, researchers were able to collect data from the assessment and formulate a conclusion based on the following results. In the assessment where there was simple mathematical application applied, all 30 individuals were able to correctly solve the mathematical problems. Roughly 33% of the test subjects did not enter their last name in the question asking for their name. When prompted to enter their home address, individuals had followed the format but had left out the end piece of entering their city state and zip code. There were about 17 cases in which this error was made. In the assessment, subjects were asked to observe an image and write down the objects name in the text boxes that followed. Subjects were able to fill out the question correctly, however there were two cases in which the answers were completely incorrect. Some subjects did not follow the instructions properly and listed the items in an incorrect order. The interesting fact from this question was that most of the subjects wrote the same answers for objects that were left to interpretation (i.e. couch and tissues). There were questions that tested for mild or even severe dementia (Q10 – Q13 and Q16). Researchers were able to conclude that zero test subjects had issues with answering the questions correctly. When asked to drag and drop items into the correct box, and rearranging words in alphabetical order, test subjects were able to do this correctly, which meant that their critical thinking skills were not fading, and that the frontal lobes of the brain were functioning fully with no discrepancies. One crucial finding was in the remembering section of the assessment. Exam takers were asked to remember six words during the exam and were asked to recall them later on in the exam. The results were that only one in five people were able to recall all six words. The average words that were recalled were three, and it was the same three for every case. There were a few with only two words remembered, and some entered the incorrect words. After given the findings of this assessment, researchers were then drawn to a conclusion.

VI. CONCLUSION

Based on the findings of this research project, researchers were not able to conclude with the results they had found if any particular person was in fact a person with dementia. The evidence was too

inconclusive given that the variable of a person with dementia could not be administered the examination. The findings given to the researchers were truly spectacular, however, not being able to cross reference with an individual or two with dementia would have given TeleCog validity in real world situations. Researchers hope to continue this project in the future and to make proper adjustments to ensure TeleCog is a success and can impact the world to solve complex solutions one medical examination at a time.

APPENDIX

TeleCog Assessment Questions

Q1. What is your name?
Q2. How old are you?
Q3 Solve: 5+4
Q4. What is your home address?
Q5. Remember these words for later: pineapple, branch, matrix, vehicle, and rainbow
Q6. Drag the items into the correct box.

Animals	Sports	Foods
_____ Sheep (1)	_____ Sheep (1)	_____ Sheep (1)
_____ Basketball (2)	_____ Basketball (2)	_____ Basketball (2)
_____ Burger (3)	_____ Burger (3)	_____ Burger (3)
_____ Pizza (4)	_____ Pizza (4)	_____ Pizza (4)
_____ Football (5)	_____ Football (5)	_____ Football (5)
_____ Horse (6)	_____ Horse (6)	_____ Horse (6)
_____ Rice (7)	_____ Rice (7)	_____ Rice (7)
_____ Soccer (8)	_____ Soccer (8)	_____ Soccer (8)
_____ Lion (9)	_____ Lion (9)	_____ Lion (9)
_____ Baseball (10)	_____ Baseball (10)	_____ Baseball (10)
_____ Tiger (11)	_____ Tiger (11)	_____ Tiger (11)
_____ Mac and Cheese (12)	_____ Mac and Cheese (12)	_____ Mac and Cheese (12)
_____ Tennis (13)	_____ Tennis (13)	_____ Tennis (13)
_____ Zebra (14)	_____ Zebra (14)	_____ Zebra (14)
_____ Apple Pie (15)	_____ Apple Pie (15)	_____ Apple Pie (15)

Q7. Look at the objects below

List the objects in the image above from left to right

Q8. Rearrange in alphabetical order
_____ Zebra (1)
_____ Pizza (2)
_____ Arm (3)
_____ Hand (4)
_____ Monster (5)
_____ Peach (6)
_____ Wonderful (7)
_____ Dog (8)
_____ Computer (9)
_____ Kitchen (10)
_____ Super (11)
_____ Smart (12)

Q9. Please enter the words from Question 5
Q10. When will you have your next meal?
Q11. What meal will you be having?

- Lunch (1)
- Breakfast (2)
- Dinner (3)

Q12. Do you have children?

- Yes (1)
- No (2)

Q13. What is your spouse's name?

Q14. How many sides does a triangle have?

Q15. What is the current month?

Q16. In case of an emergency, who will you contact?

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REFERENCES

[1] D. P. Rice and J. J. Feldman, "Living longer in the United States: Demographic changes and health needs of the elderly," *The Milbank Memorial Fund Quarterly. Health and Society*, pp. 362-396, 1983.

[2] I. McDowell, B. Kristjansson, G. Hill, and R. Hebert, "Community screening for dementia: The mini mental state exam (MMSE) and modified mini-mental state exam (3MS) compared," *Journal of clinical epidemiology*, vol. 50, no. 4, pp. 377-383, 1997.

[3] E. L. Teng *et al.*, "The Cognitive Abilities Screening Instrument (CASI): a practical test for cross-cultural epidemiological studies of dementia," *International Psychogeriatric*, vol. 6, no. 01, pp. 45-58, 1994.

[4] J. E. Storey, J. T. Rowland, D. A. Conforti, and H. G. Dickson, "The Rowland universal dementia assessment scale (RUDAS): a multicultural cognitive assessment scale," *International Psychogeriatrics*, vol. 16, no. 01, pp. 13-31, 2004.

[5] E. Gould and P. Basta, "Home is where the heart Is—for people in all stages of dementia," *Generations*, vol. 37, no. 3, pp. 74-78, 2013.

[6] "Dementia – Signs, Symptoms, Causes, Tests, Treatment, Care". *Alzheimer's Association*. N.p., 2016.

[7] E. Drewe, "Go-no go learning after frontal lobe lesions in humans," *Cortex*, vol. 11, no. 1, pp. 8-16, 1975.

[8] Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., & Jackson, R.B. (2011). Neurons, Synapses, and Signaling. *Campbell Biology 9th ed.* Pearson Benjamin Cummings: San Francisco. (1045-1061)

[9] R. Parasuraman and J. V. Haxby, "Attention and brain function in Alzheimer's disease: A review," *Neuropsychology*, vol. 7, no. 3, p. 242, 1993.

[10] C. Solé-Padullés *et al.*, "Brain structure and function related to cognitive reserve variables in normal aging, mild cognitive impairment and Alzheimer's disease," *Neurobiology of aging*, vol. 30, no. 7, pp. 1114-1124, 2009.

[11] "About Alzheimer's disease: Alzheimer's Basics", *National Institute on Aging*, 2016.

[12] Reisberg, et al., 1982; Deleon and Reisberg, 1999

[13] V. A. Moyer, "Screening for cognitive impairment in older adults: US Preventive Services Task Force recommendation statement," *Annals of internal medicine*, vol. 160, no. 11, pp. 791-797, 2014.

[14] W. E. Mansbach, E. E. MacDougall, K. M. Clark, and R. A. Mace, "Preliminary investigation of the Kitchen Picture Test (KPT): A new screening test of practical judgment for older adults," *Aging, Neuropsychology, and Cognition*, vol. 21, no. 6, pp. 674-692, 2014.

[15] S. E. O'Bryant *et al.*, "Detecting dementia with the mini-mental state examination in highly educated individuals," *Archives of neurology*, vol. 65, no. 7, pp. 963-967, 2008.

[16] H. Brodaty *et al.*, "Screening for Dementia in Primary Care: A Comparison of the GPCOG and the MMSE," *Dementia and Geriatric Cognitive Disorders*, vol. 42, no. 5-6, pp. 323-330, 2016.

[17] J. Santabárbara *et al.*, "Staging cognitive impairment and incidence of dementia," *Epidemiology and psychiatric sciences*, pp. 1-11, 2015.

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After volunteering through multiple organizations and discovering his passion for philanthropy, he and his friend from high school founded a non-profit organization with a focus on providing the homeless in NYC with the necessary resources they lack in their daily lives. Special Ops NYC has successfully provided prepackaged food and clothing through its handcrafted care-package system to over 500 homeless people in NYC. He hopes to inspire other young adults in his community to take initiative in the welfare of others in order to create a society where altruism is an essential part of everyday life. Aside from his philanthropic endeavors, he is a member of Pace University's Federal Reserve Team as a Research Analyst and aspires to become a Presenter on the team this year.

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