An open letter

To the Stanford Center on Longevity:

On October 20, 2014, you released a statement presented as "A Consensus on the Brain Training Industry from the Scientific Community." We agree strongly with parts of your statement, agree substantially with other parts, but are compelled to sign this letter to express our concern that many readers of your statement might wrongly conclude that there is no evidence that any cognitive training regimen can improve cognitive function. Given our significant reservations with the statement, we strongly disagree with your assertion that it is a "consensus" from the scientific community.

As we discuss below, a substantial and growing body of evidence shows that certain cognitive training regimens can significantly improve cognitive function, including in ways that generalize to everyday life. This includes some exercises now available commercially. Having said that, let us begin by agreeing with you on many good points.

We strongly agree that:

- No one should say or imply that products have scientific evidence where there is no or little evidence for those claims.
- Cognitive training programs should be evaluated in peer-reviewed, randomized, controlled trials.
- Evidence is stronger if run independently, funded independently, run at multiple sites, and if it evaluates program benefits by comparison with "active" control activities.
- Many companies that claim to provide brain fitness have not subjected their exercises to peer-reviewed trials to show any efficacy.
- Claims promoting brain games are frequently exaggerated, and are often misleading.

We also agree that to be fully credible, tests of brain exercises need to address the following questions, which you posed:

- Does the improvement encompass a broad array of tasks that constitute a particular ability, or does it just reflect the acquisition of specific skills?
- Do the gains persist for a reasonable amount of time?
- Are the positive changes noticed in real-life indices of cognitive health?
- What role do motivations and expectations play in bringing about improvements in cognition?

These are good questions and a number of studies have already been undertaken and published that seek to answer them.

We also substantially agree with five bullets at the conclusion of your statement, although we would word them differently (as we have below):

- More research needs to be done.
- Physical exercise is good for physical health and brain health.

- A single study generally is not conclusive and needs to be integrated into a larger body of evidence.
- No study, to date, has demonstrated that brain training cures or prevents Alzheimer's disease.
- Cognitively challenging activities have not been shown to work like one-shot treatments or vaccines.

We also agree that many brain fitness providers are subject to criticism for exaggeration, overstatement, and errors of omission in marketing their products.

By the same token, when critics make the case for more responsible corporate behavior, they should take particular care to not engage in the same kinds of behaviors.

We cannot agree with the part of your statement that says "there is no compelling scientific evidence" that brain exercises "offer consumers a scientifically grounded avenue to reduce or reverse cognitive decline." We fear that most readers would take this to mean there is little or no peer-reviewed evidence that certain brain exercises have been shown to drive cognitive improvements. There is, in fact, a large and growing body of such evidence. That evidence now includes dozens of randomized, controlled trials published in peer-reviewed journals that document specific benefits of defined types of cognitive training. Many of these studies show improvements that encompass a broad array of cognitive and everyday activities, show gains that persist for a reasonable amount of time, document positive changes in real-life indices of cognitive health, and employ control strategies designed to account for "placebo" effects. While we can debate strengths and limitations of each study, it is a serious error of omission to ignore such studies in a consensus reviewing the state of this science.

Over three decades, researchers have built a huge body of evidence that brain plasticity is a lifelong phenomenon – as you acknowledge. However, the statement fails to acknowledge that this evidence was derived from training experiments directly documenting the improvement of sensory, cognitive, motor, and functional performance.

We believe that by not acknowledging (1) the training basis of the literature that shows that brain plasticity exists throughout the brain and throughout life, (2) the many demonstrations of the effectiveness of well-designed plasticity-based training regimens, and (3) the specific findings of efficacy in the area of aging, your statement derogates the time, effort, and expertise of the thousands of scientists and clinicians engaged in designing, conducting, analyzing, publishing, and reviewing the research. It also diminishes the contribution of thousands of volunteer research participants who gave their time and effort to these studies, and the time, effort, and expertise of the grant-makers who awarded the funding for most of these studies through the National Institutes of Health, other government agencies, and foundations. In addition, it short-changes the taxpayers who funded this well-conducted research.

We also believe the failure to recognize the results of well-run studies makes further investment of time, effort, and money in plasticity-based improvements to the human condition less likely. Regrettably, your statement contributes to precisely the environment that you (and we) seek to discourage – one where investments in science are outweighed by investments in advertising. It

causes real harm by discouraging use of validated exercises by people who could benefit from them.

As scientists, we believe it is imperative to look at all of the evidence when coming to a scientific consensus. We need to be open, especially, to evidence that may not fit our current worldview, because that is often where new discovery lies and how scientific consensus changes. That is certainly the case in the field of neuroplasticity historically, where, not long ago, a few lone voices, including some signatories to this letter, began the process of overturning the scientific consensus that brain plasticity ended with childhood – a now abandoned consensus that held back many advances to public health.

We present this letter as a consensus of its signatories, all of whom are also members of the scientific community.