Dear Dr. Haikonen,

I have downloaded from the Internet and read your paper titled, Reflections of Consciousness: The Mirror Test. (http://www.consciousness.it/CAI/online_papers/Haikonen.pdf)

I would like to ask you some questions about the content of your paper, and would appreciate receiving an answer.

(Haikonen's Mirror Test)

Your paper introduces the following simple device and asserts that it passes the Mirror Test. The explanations for Fig. 1 in the paper include the following [1].

I will call the experiment on the Mirror Test using the device, “Haikonen’s Mirror Test.” Shown below is the circuit of the device: the circuit is taken from your paper. Some parts of the circuit are numbered for explanatory convenience.

Figure 1. A trivial circuit that “pass” the mirror test.

(Taken from [1]. Symbols have been added to some parts of the circuit.)
I will describe the device embodiment process as outlined in your paper [1].

I understand that, in this device, the optical signal from the LED (Fig. 1,(2)) is irradiated against the mirror (Fig. 1, (6)) and the light reflected on the mirror is received by the photo-diode (Fig. 1, (3)), and the light is then converted into a digital signal on the detector (Fig. 1, (4)). The results of the conversion appear on the signal $R$. I assume you think that signal $R$ can be expected to be the same as signal $T$ because signal $T$ is a direct signal from the pulse generator (Fig. 1, (1)).

I think you are asserting that the device outputs “self-image detected” because signal $S$ agrees with signal $T$, as ”self-image detected” is written under the output terminal $S$.

The explanation of Fig. 1 in the paper describes “A trivial circuit that passes the mirror test” and asserts that the device in Fig. 1 “passes the mirror test.” Also, the paper says that the device has no advanced cognitive functions.

For the following reasons however, I think it is questionable to assert that the device “passes the mirror test.”

Firstly, it is necessary to give an overview of the “Mirror Test.”

Generally, a “Mirror Test” is described briefly as “a test on a subject to evaluate its ability to recognize its image reflected in a mirror.” This is based on the assumption that, because I am aware of my image reflected in a mirror, the fact that a subject is aware of its image reflected in a mirror can be used to check whether the subject is capable of self-consciousness. Self-consciousness mentioned here means being aware of the existence of self. It is also called “self-awareness.”

Thus, we must not forget that, when performing a Mirror Test on a subject other than a human, there is an intention of conjecturing that the subject possesses self-consciousness.

Under such considerations, when performing a Mirror Test, we must consider the “timing of achieving self-consciousness” or the “timing of being able to recognize one’s self-image.” A human cannot recognize his/her self-image until 1.5 – 2 years of age [2], at which stage the human moves from a “state of being incapable” to a “state of being capable” of recognizing his/her self-image in a mirror. A human is considered able to achieve self-consciousness at this stage. Jacques Lacan [3] named this stage the “mirror stage” [4] and noted that the stage was very important for the development of the
consciousness of a human.

After passing through this stage, a human becomes considerably conscious of himself/herself, discriminating between himself/herself and others, and of feeling a sense of shame.

What I would like to assert is that, in a Mirror Test as a means of conjecturing that a subject other than a human has self-consciousness, the process of moving from a stage of being incapable to a stage of being autonomously capable of recognizing the self-image in a mirror is an important viewpoint. If the process has been achieved, the subject can pass the Mirror Test anytime. I named this process the “mirror image cognition [5] (I call MiC).”

I think that this process, if it is recognizable in the subject, could be recognized as the first step in demonstrating the existence of self-consciousness, and the subject could pass the Mirror Test.

I think that you judged the image in the mirror as a self-image when signal S agrees with signal T of the device, and as another image, which is not the self-image, when signal S does not agree with signal T.

In other words, I assume you think that your device passes the Mirror Test because the device can discriminate between self-image and another image, and consequently is capable of detecting its self-image.

If so, I have a question. Is your claim based on “the assumption that the MiC process has already been achieved in the device?” In short, did your device already use the “mirror function” without the consideration on the experiment? The mirror function means “the mirror can reflect a self-image and the other images on it.”

And I have another question. Why does your device already have complete self-image data? Did you give the data to the device?

Have you proved that you know the complete self-image data?
If you have the proof, please show me.

If “Haikonen’s Mirror Test” was performed without these considerations, I think that the test was incomplete as a Mirror Test.

I am afraid that you are simply thinking too much about the Mirror Test.

To be able to declare that an artificial device “passes a mirror test,” the device must be shown to have achieved the MiC process or at least a clearly documented explanation.
must be given to clarify that the device can in fact achieve the process. And naturally, the device cannot be given the complete self-image data at the beginning.

Therefore, building an artificial device which is able to pass the Mirror Test has been very difficult work.

Finally, I think that the device shown in Fig. 2 which can explain advanced functions such as cognition and consciousness is the only device worthy of consideration and can be realized through a "unified complex combination of simple reflexive mechanisms." This self-conscious unit should be capable of not only “passing the mirror test,” but also of explaining, as a basic model, the essential items of human consciousness comprehensively and uniformly[6],[7].

I believe that the device shown in Fig. 2 should be the first objective in the study of human consciousness.

![Figure 2. A self-conscious unit that “pass” the mirror test.](image)

**Reference:**


493-498.


Reply from Dr. Haikonen (6th February 2008)

Dear professor Takeno

I am very honored that you have seen my modest paper, which I have presented at the AAAI fall symposium last year.

My point in this paper is:

It is easy to create an artifact (the circuit of the figure 1.) that APPEARS to pass the mirror test, because, in technical terms it has the minimum means for detecting its own very special reflection in the mirror. However, The word <pass> is in quotation marks because this trivial operation IS NOT true passing of the mirror test, a fact that I think I explain clearly in the text. (In the western tradition quotation marks are also used to indicate that something is not actually real.)

In order to pass the mirror test properly the system must have something more in the way of self-concept, which I elaborate in the text. It appears that you are proposing similar requirements in your open letter. Therefore I have no objections towards the points that you raise in your kind letter.

In my paper I present my elaborations within the framework of the cognitive system that I have presented in my books

"The Cognitive Approach to Conscious Machines" (general principles, no mathematics)

http://www.amazon.co.uk/exec/obidos/tg/stores/detail/glance/-/books/0907845428/202-5292375-6130220

and

"Robot Brains: Circuits and Systems for Conscious Machines" (detailed
information for engineers)

http://www.amazon.co.uk/Robot-Brains-Circuits-Conscious-Machines/dp/0470062045/ref=sr_1_1/202-8131832-20342367?ie=UTF8&s=books&qid=1176881649&sr=1-1

It was very kind of you to contact me in this matter.

Best Regards

Pentti O A Haikonen, Dr. Tech.
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Letter from Junichi Takeno (27th February 2008)

Dear Dr. Pentti Haikonen:

Thank you very much for your prompt and courteous reply. I am deeply honored to receive your comments personally.

I note you mean that the system (the circuit in Fig. 1) shown in your paper [1] looks like passing the mirror test, but in fact this is not a true passing of the mirror test.

I also note you agree that more stringent requirements such as those mentioned in my letter must be satisfied for an artificial system to pass the mirror test properly.

I appreciate these comments of yours.

(My next questions)
The artifact (the circuit in Fig. 1), or a system, that appears to pass the mirror test is shown in your paper.

Your paper indicates that that above-mentioned system of yours appears to pass the mirror test because the system will detect the self image when signals R and T correspond to each other [1].

I have doubts about you saying that “signals R and T correspond to each other.”

I wonder if you actually built the system and carried out mirror tests with the system.

In my opinion, signals R and T in your system cannot logically correspond to each other. I wonder how you determined the correspondence between signals R and T.

Firstly, optical signals emitted from the LED are generated from digital signals in your system. But, digital signals normally cannot be converted into analog optical signals correctly.

Secondly, optical reflectance of a mirror is generally about 85% depending on wavelength. This means that optical energy is destined to decay.

Thirdly, in general there are many light sources incurring noise in a room when experiments are
carried out.

Finally, photo diodes cannot correctly convert analog signals into digital signals.

The above facts indicate that signals R and T cannot correspond to each other correctly in a natural environment.

I am wondering if you actually built this system and tested it.

I shall be much obliged to be favored with your reply to my questions.

Your reply to this letter would provide useful information to young people and researchers who are interested and engaged in this study. I kindly ask if you could allow me to post your reply as an open letter on the web site of Meiji University where I work.

I shall be much obliged to hear from you.

Thanking you I remain,

Yours truly,

Junichi Takeno, Meiji University.
takeno@cs.meiji.ac.jp

Date: 27th February 2008.

Reference:
[1] Pentti OA Haikonen: Reflections of Consciousness; The Mirror Test,
    http://www.consciousness.it/CAI/online_papers/Haikonen.pdf
Dear professor Takeno

Thank you for your kind response. Here are my comments.

The figure 1 in my paper shows the general principle only. In practice one will encounter the practical problems that you explain so well in your letter. However, I have built systems like these and there are many ways of doing it properly.

Presently there exists a microchip that does the required operation easily, namely the type IS471F made by SHARP. A data sheet can be found here:


This microchip contains an oscillator that is used to feed an external LED and a photodiode with a synchronous detector for the incoming light. Due to this mode of detection the effect of external light sources is minimized. (The synchronous detector effectively does the R*T multiplication of my circuit of the figure 1. This multiplication and subsequent integration or filtering will remove the effects of external lights and disturbance.)

Of course, in this application you may have to tailor the system by adding some optical elements that shape and limit the optical view so that only a direct reflection from a mirror will cause the detection signal. With this microchip it should be easy to build toys that would appear to recognize themselves in a mirror along the lines that I explained in my paper. Of course no real self-consciousness would be present.

I hope that this helps you. Please feel free to contact me if you have any further questions.
You are welcome to post this letter on your web site.

Best Regards

Pentti O A Haikonen, Dr. Tech.
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To be continued