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Do Human Fingers "See"? — "Finger-Reading" Studies in the East and West

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Abstract

The "finger-reading" effect refers to successful touch identification of apparently flat targets on paper, where the participant is unable to see, or feel, any normal sensory cues to aid touch identification. Studies of this have been running for over 10 years in Taiwan. A quarter of children, after finger-reading training, appeared to be able to determine the identity of targets by means of directly touching a flat target varying in four different colours printed by an ink printer on paper. In the West, one study indicates that the fingers might read printing on paper without sight, while six studies find that fingers alone can discriminate colours on paper. However, a discussion of methodological issues follows, which points out the deficiency of well-controlled conditions in all the finger-reading studies reviewed. This leads to a conclusion that fraud has not been entirely ruled out – suggesting unreliable finger-reading results. In addition, this finger-reading effect has never been replicated. It is thus not safe to assume that exceptional abilities were in fact successfully measured. It is suggested that finger-reading needs to be further explored under stringent conditions, especially in children.

Introduction

Recently, attempts have been made to explore possible exceptional human abilities in Chinese societies. Si-Chen Lee, a professor of the

Correspondence details: Yung-Jong Shiah, Psychology Department, The University of Edinburgh, Edinburgh, Scotland, EH8 9JZ, United Kingdom. Email: s0239482@sms.ed.ac.uk. This paper is dedicated to Professor Robert L. Morris, the first author's late supervisor, who sadly died before publication.

Electrical Engineering Department at National Taiwan University and also the President of the most prestigious university in Taiwan, began to focus on finger reading from 1993 by way of a developed training paradigm. The first author was a member of his research team from 2000 to 2002. Following this, since 2003, the first author has studied at the Koestler Parapsychology Unit to learn about applying more rigorous scientific methodology to the exploration of exceptional human abilities, with a view to looking at possible explanations for the finger-reading effect.

A quarter of children, after finger-reading training, appeared to be able to determine the identity of targets by means of directly touching a two-digit number or a complex character varying in four different colours printed by an ink printer on paper. Some Chinese children seemed able to do this when other senses such as vision were ruled out. This "touch" effect has also been reported occasionally in Western experiments for more than a century. According to Novomeysky (1965), the first report of finger reading was published in Russian scientific literature in 1898. Since then, several studies were conducted to explore this effect. The results of Western studies apparently showed positive results. However, poor experimental design was used in most of the studies (Gardner, 1996). In addition, many of the participants who claimed to have this ability were found to be cheating e.g., peeking at targets (Gardner, 1966). The last Western study of finger reading was undertaken in 1992. Since then, no further research about finger-reading effect has been conducted in the West.

In fact, the finger-reading effect is also subject to criticism in Taiwan (Du, 2005). Does finger-reading ability really exist? Were the successful studies merely replicating errors and were they open to fraud? Could it just be an example of a performance using tactile cues? Before addressing those questions, we had better take a look at finger-reading studies in the East and the West. In what follows, finger-reading studies in the East and West will be reviewed and their limitations will be scrutinized. Future research will be suggested.

Studies of "finger reading" in Chinese society

On 11th Mach 1979, a boy aged 12 was reported by the Sichuan Daily in mainland China as seemingly possessing an "ear reading" capability, i.e. he was able to recognise characters written on a piece of paper screwed into a ball and put into his ear (Chien, 1981; Eisenberg, 1985; Gardner, 1996). Since then, hundreds of Chinese children have been reported as appearing to possess this ability. Sometimes a folded paper involving Chinese characters was placed into children's hands or armpits. One of the more recurrent claims of possession of exceptional ability was for a finger-reading capability (Lee, 1998; Wang et al., 1989). Empirically, it was further reported that this ability could be induced by intensive training. For example, out of forty children of ages ranging from five to fourteen, 15 appeared to show this touch effect after between three and ten training sessions (Chen et al., 1989). In this training programme, children were instructed to use their fingers directly to touch a paper with written Chinese characters. It was even claimed that children seemed able to read characters within folded paper after more training. The children reported that the targets seemed to appear in their minds as a real visual image even when other senses, such as vision, were ruled out. The researchers assumed this to be a demonstration of something like extra-sensory perception (ESP) (Lo et al., 1989; Shao et al., 1982; Tien, 1994; Wang et al., 1989). ESP is a general term used for all paranormal abilities that cannot be explained by "rational" terms (Irwin, 2004).

This finger-reading effect caught the attention of Si-Chen Lee. He gathered a research team to study this touch effect and developed a four-days-a-week, two-hour finger-reading programme to study these phenomena in Taiwan from 1993 onwards (Lee, 1998, 1999, 2002, 2003; Lee & Chang, 2001; Lee, Chen, & Tang, 2000; Lee, Tang, & Kuo, 2004; Tang, Lee, & Hsu, 2000). Briefly, the research team conducted a variety of training and testing procedures, and found that children, aged between seven and thirteen, were the easiest to train. Si-Chen Lee trained adults at first as well, but they seemed to benefit little from this training process and failed to show any positive results. It appeared to be very hard for adults to learn how to visualise targets during the training process.

The training procedures can be illustrated briefly as follows: First, the children were given imagery exercises. The children were trained by letting them touch a paper directly which bore a two-digit number or a complex character printed in four different colours from an ink printer. This training included a "dark" condition in which the paper with its character was put into a dark bag where it could not be seen. Then they were asked to imagine that they could see the numbers, characters or words while touching them. The children were encouraged to practise touching and visual imagery during this training process. The procedural training details will be covered and discussed later.

216 participants, aged seven to thirteen, were recruited from different elementary schools during the years 1996 to 2004. The average success rate at recognition (by $p < .05$ criterion) by means of directly touching an unseen paper with a two-digit number or a complex character varying in four different colours was approximately 24% (41 out of the 173 participants who went through the whole training programme). The dropout rate was about 20% (43 participants). The major reason for leaving the training programme was that the children felt the programme was somewhat tedious and time-consuming.

The children for whom the techniques seemed to be successful reported that visual experiences had accompanied their successful trials. They reported visual images appearing as if from the real world. They reported seeing a "transparent screen" like a mist, with a floating patch or pattern overlaying their field of vision. Some of the children experienced the coloured targets as a distinct form of imagery like an "opaque screen" masking the normal visual image. The quality of the screen reported by participants seems important for this touch effect; for example, children appeared to recognise easily complex characters or other complex symbols after seeing an opaque screen. The experience of this opaque screen in the mind correlated highly with correct recognition. It might be trained by touching a complex character, producing a more complex visual image display in the children's minds. The shortest training time was only 20 minutes.

Studies of "finger reading" in Western society

Novomeysky (1965) conducted a study employing 80 participants and found that participants distinguished well between colours presented in pairs just by touching, without seeing them. After two or three weeks of exercises, one-sixth of participants learned to recognise five to seven colours just by touching paper. In 1919, the finger-reading effect was investigated by the French novelist, poet and dramatist Romains. Romains' book was translated into English, entitled *Eyeless Vision*, in 1924. Romains investigated French women who claimed they could read without seeing, being blindfolded (Duplessis, 1975; Gardner, 1966).

One piece of evidence for tactile-colour sensitivity was replicated by Nash (1969): participants significantly distinguished black and red paper by touching without seeing ($p < .05$). Later, in response to Gardner's (1966) criticism of the lack of control of the peeking problem, a head box constructed of 3/8-inch thick plywood was employed (Nash, 1971). This box fitted over the participants' heads and rested on their shoulders and came completely under the chin to fit snugly around the neck. He found the same positive results as in his previous study of 1969 ($p < .001$).

A similar result was found among blind people. A 30 year old blind woman, who had been totally blind since the age of 18, was found to discriminate four colours on paper with a significant result ($p < .001$) (Moss, Gray, Hubacher, & Bush, 1972). Both blind and normally sighted people were found to be able to discriminate colours by touch on paper (Duplessis, 1978).

Overall findings

All studies reviewed suggest that fingers might be able to detect colours on paper. With respect to recognising printing, only one Western study, but all the Eastern studies found significant results.

One of the major differences between Western and Eastern studies is that Lee developed formal procedures targeted at children for developing finger-reading ability. According to this training paradigm, a visual experience accompanied with the correct answers was suggested to play the key role in helping participants successfully identify targets. This might indicate that reporting seeing a visual screen might be a good predictor of finger-reading ability. It is worthwhile investigating this claim. If finger-reading ability is real, one might expect its manifestations to be predictable. However, it should be noted that well-controlled conditions are of particular importance while conducting this investigation, as will be discussed later.

The other difference is that only children, and not adults were recruited as participants in the Eastern studies. As noted before, children seemed to perform better than adults did in Lee's finger-reading studies, revealing a reason for exploring ESP and children. Many parapsychological studies have focused on examining the relationship between adults and ESP, with little research examining children and ESP. In this regard, little is known about the topic of ESP in children. The cause of children performing better than adults did in Lee's studies is unknown. Indeed, over the years, researchers have noticed that children might be a potential group for demonstrating ESP ability (Bourgeois & Palmer, 2002; Rhine, 1965). Although it is not easy to conduct child parapsychological experiments, children might provide us with remarkable performances and phenomena (Alvarado, 2001). For example, some studies show a negative relation between ESP performance and aging (Bourgeois & Palmer, 2002; Shargal, 1987; Spinelli, 1977; Van Busschhach, 1959).

Problems and limits of the previous studies

Methodological problems

The very important issue of experimental controls developed and discussed in parapsychological studies provides a good checklist with which to examine finger-reading studies (Kennedy, 2004; Lamont & Wiseman, 1999; Milton, 1996; Morris, 1987, 1999, 2001; Steinkamp, Milton, & Morris, 1998; Wiseman & Morris, 1995).

Methodological problems in the Eastern studies: No satisfactory explanations of the phenomena were given, nor were the procedures described in sufficient detail in published reports done in Mainland China. Thus, the whole process cannot be evaluated. It is not clear whether the researchers ruled out fraudulent techniques such as those used in performance magic. For example, in 1981, children were caught peeking by scientists during finger-reading tests (Gardner, 1996).

Before examining Lee's finger-reading training paradigm, we should take a look at his training procedures. Lee's training procedures have never been mentioned in detail in any published journal. Most of the procedures depend on the first author's observations during the time when he worked with Si-Chen Lee, who helped to clarify some of the described procedures.

Summary of Lee's finger-reading training procedures: The stimuli consisted of 5cm $\times$ 8 cm rectangular pieces of paper. In the middle of each paper was a two-digit number in one of four different colours (black, green, blue and red) printed by an ink printer. There were two-digit numbers from 10 to 99. Confounding numbers, or "double chance numbers," such as 16 and 91, 19 and 61, 18 and 81, 66 and 99, 69 and 96, 68 and 89, 86 and 98, were excluded, so there were 76 numbers used in all. The trial samples were always prepared by a research assistant who did not participate in the finger-reading training process. They were folded twice and all put into a big envelope. Each sample was only used once in all procedures. In Training 2, the digit was replaced by a Chinese character. Sometimes, for example, in some special conditions, the stimuli were drawn on a 5cm $\times$ 10cm or 3cm $\times$ 10cm rectangular piece of white paper (Lee, 1998; Lee et al, 2000). Written or printed on the paper was a Chinese character or an English word or a symbol or mathematical formula.

A specialised black bag, used for handling photographic negatives, was employed as a barrier against sensory leakage. Two cuffs are snugly fitted around the participant's forearms and the bag has two layers, each with its own zipper. Hardly any light could enter the bag, as was empirically shown by a light detector. The participant could move and feel around freely within the bag. The purpose of the bag was to prevent the participants, experimenter and co-experimenters from seeing or peeking at the targets.

A three-stage, specialised training procedure was used in the experiments. Participants were first required to participate in 'warm-up training', where they watched a 30-minute videotape describing this "touch" phenomenon, such as how to identify the target. First of all, participants were required to sit and close their eyes and breathe deeply with a calm and peaceful mind for at least ten minutes. Then participants were required to practise image-making. The experimenter showed an object, such as a red apple, to the participants who were asked to look at the apple very carefully and remember every detail of it. Then they closed their eyes to visualise the apple exactly as they perceived it. Next, they visualise the apple changing its colour three or four different times i.e., through green, blue and black.

Participants then moved onto training procedure 1 which involved directly touching a two-digit number.The experimenter usually drew ten samples randomly from the big envelope and put them on the co-experimenter's chair. Then, the co-experimenter clenched one sample in his or her fist and put it the bag, and then closed the zippers. Participants must not see the target during this process. Next, participants put their hands into the two sleeves of the black bag and the sleeves were tied up. Participants were then required to open the folded samples and use their fingers to feel the targets. Participants were asked to focus on touch and to imagine that they can see the numbers while touching. There were no time restrictions and participants were free to use whatever scanning force and speed they chose. They removed their hands to write down the answer whenever they had told the co-experimenter what they saw, and the co-experimenter had recorded their response too. The co-experimenter then took out the training item from the black bag and showed the number to the participant. Thus, participants received feedback and the co-experimenter recorded if the participant's response was correct. Usually, children could try 20 items in one session within two hours.

Finally, participants who had a statistically significant performance level and subjectively report experiencing a subjective visual experience, usually a transparent screen in their mind, were invited to attend Training procedure 2, which involved directly touching a complex target (a Chinese character). This training procedure is the same as the training procedure for directly touching a target (a two digit number), but the stimulus was now a Chinese character. Sometimes, in special conditions, one experimenter and several co-experimenters carefully watched the participant in Training procedures 1 and 2.

Inadequate controls in Lee's procedures: The first issue in Lee's procedures is the problem of randomisation, as weak randomisation procedures are considered a serious problem (Bierman, Broughton, & Berger, 1998; Brugger & Taylor, 2003; Diaconis, 1978). A target should be selected randomly from target pools. The experimenter randomly drew several samples from the envelope (samples pool) and gave them to each co-experimenter. Plainly, this randomisation is inadequate.

Sensory leakage is also an issue in Lee's procedures, and this refers to participants obtaining information from sensory other than from extrasensory (Irwin, 2004). Usually, one co-experimenter worked with two participants, or sometimes three participants. The co-experimenter could not carefully observe each participant's responses and behaviour. The authors suggest that at least one experimenter and one co-experimenter or more work with each participant.

The experimenter put samples on the co-experimenter's chair and the participants cannot see the samples. Although the sample — a small piece of paper — was folded twice to prevent seeing or peeking, a remote possibility existed that the experimenter or co-experimenters might see the mark from the outside. The authors suggest that the samples should be put into an envelope before each trial.

The production of stimuli should be standardized in both procedures. Detailed information on how targets are prepared should be given. A tactile cue might be present due to different printing quality, especially in written samples. The procedures had not been examined by an expert in detecting fraud, so they may be open to cheating.

There is also an issue surrounding the participants and potential recording problems. The authors suggest that participants who have a history of nerve or brain injury, finger trauma, or learning disability (including dyslexia), diabetes (because of associated peripheral neuropathy) and callouses on their finger tips should be excluded. These factors might affect tactile learning results (Goldreich & Kanics, 2003; Vega-Bermudez & Johnson, 2004).

Although over two hundred children have taken part in Lee's finger-reading training, their psychological traits and demographical background have not been studied. Such information might provide useful explanations for the finger-reading effect. After discovering which variables best predict the finger-reading effect, we could be in a position to discuss which assumptions or theories are closely related to explaining the phenomena.

It is not clear if records of participants were double-checked by at least two different researchers/co-experimenters to avoid calculation error. Only individual scoring was analysed and not all the participants' trials were reported. All the trials for each participant should be clearly noted, as well as the method of analysis.

Methodological problems in the West: Likewise, Western finger-reading studies did not provide fully detailed information of randomisation procedures. They exhibit the same problems with participants and recording as described above. Sensory leakage is also a serious problem. For example, blindfolds have been found to provide only a rather weak control (Gardner, 1996). Wearing a pair of blindfolds was used in Novomeysky's and Romans's studies but this still provided only a weak safeguard against cheating, because it was possible for blindfolded people to see down through tiny openings made by muscular contortions or eye twitching. For this reason, it is not clear that Romains' investigation ruled out cheating.

Claims that the finger-reading studies lacked sufficiently tight controls to rule out trickery were often reported, with peeking being an especially common problem. For example, according to Gardner's report

(Gardner, 1996), one 13 year-old boy in a 1937 study claimed that he could name playing cards without seeing them. However, J. B. Rhine, the famous parapsychologist at Duke University, tested this boy with opaque goggles and found him to be cheating by peeking over the bridge of his nose. In 1962, a 22 year-old Russian epileptic patient claimed to be able read while blindfolded, but she, too, was caught cheating by scientists. Also, in another study (Zubin, 1965), a 15 year-old girl claiming to have this kind of ability was tested. She wore a blindfold taped to her face around its edge and was found to have tensed the muscles in the areas of her blindfold to cause a very tiny opening allowing peeking down the side of the nose.

Common problems and limits of the previous studies: Actually, methodological issues are a very serious problem in all finger-reading studies. In addition to the described problems, not one of reviewed studies provided fully detailed information about its safeguards. For example, measures to prevent cheating, such as a possible access to target pools, changing experimental records and replacing targets, should be implemented. Details of the materials and how targets are kept secure between being taken out of storage and being used in experiments must be noted. Clearly, bad methodological design has been a major problem in all finger-reading studies. Still worse, some of the participants have figured out how to cheat.

Regarding the printing quality, it was suggested we could accurately identify touch recognition in terms of about three levels of intensity (Geldard, 1960). We can detect a very small difference of particle sizes with thresholds between .0024 and .0033 mm and the difference of ridge height thresholds was between .00095 and .002 mm (Miyaoka, Mano, & Ohka, 1990). Different printed colours might cause different levels of touch intensity, providing a tactile cue to detect different colours, especially when the participants only had to discriminate two colours on the same trial in Novomeysky's study. The details of how the samples were obtained were not fully noted in all previous finger-reading studies. In this case, the possibility of tactile cues cannot be excluded.

Finally, there is an issue surrounding replication. If the finger-reading effect cannot be replicated reliably, it will lose credibility. Many researchers (Alcock, 2003; Burns, 2003; Jeffers, 2003; Milton & Wiseman, 1999, 2001) have pointed out that no sufficient evidence has proved the existence of ESP. The results of ESP performance have been found elusive, weak, unreliable and lacking in quantity (Kennedy, 2001). This leads to other problems, such as unpredictability, lack of progress and failure to propose coherent explanatory theories (Alcock, 2003). Likewise, the finger-reading effect is now facing the problem of replication. No-one has replicated Lee's finding using his training paradigm.

The reviewed studies indicate that fingers might be able to recognise colours on paper, but are vulnerable to poor methodology as above. The methodological quality of a study is an important criterion for its inclusion in a meta-analysis (Rosenthal, 1995). For this reason, the authors suggest that all of these studies cannot be selected in any meta-analysis.

In summary, replication of the finger-reading effect with respect to recognising colours or print is wanting.

Incomplete potential mechanisms and explanations

Attempts to explain the finger-reading effect have been made. One of the very important questions was "Can our skin see or perceive radiation?" For instance, perceiving light or radiation has been suggested as a possible normal explanation of the finger-reading effect. In one experiment (Barrett & Rice-Evans, 1964), the participants were given a dim and low-level visible light condition (.00012 lumens/cm^2). It was of 3.5 times the intensity of the black condition. No participant showed a significantly improved performance.

To the best of our knowledge, retinal photoreceptors are only found in the eye's rod and cone cells, with an exception that photoreceptors, which contain light-absorbing photopigment, are found not restricted to just rod and cone cells in the salmon's eyes (Soni, Philp & Foster, 1998). It is suggested that, evolutionarily, pigment cells in the skin may be precursors of the photoreceptor cells in the eyes (Arnheiter, 1998). However, the human skin only unconsciously responds to light, especially the ultraviolet-B (UVB) light (290–320nm) and ultraviolet-A (UVA) light (320–400 nm) wavelengths, resulting in the production of vitamin D and thus affecting skin pigmentation. The level of skin pigmentation works to prevent UVB radiation damage (Slominski, Tobin, Shibahara, & Wortsman, 2004). Light-absorbing photopigment, reactive to 400-700nm, has not been found in human skin. The existing evidence indicates that human skin cannot "see".

Regarding detecting radiation, everything has its own radiation. For example, in a paper with printed characters, the printed targets and the paper involve different materials. Thus, it is logical to infer that they have different radiation levels, which might, perhaps, lead to different levels of radiation feedback. Fingers might be able to detect the differences in radiation reflected by colours. To test this hypothesis, several attempts have been made. A higher level (60 watt lamp) testing box comprising two compartments separated by a sheet of frosted glass was used (French, 1965). Then a stack of 72 cards was put in the box. Black and white were used for the cards. The participant put one hand inside the box to go through the pack of cards and then guessed its colour under two conditions: one with the light on and the other one with light off. No positive results were found. In another study (Passini & Rainville, 1992), blind and blindfolded participants were tested to see if they could discriminate colours on boxes in normal light condition, but the result did not support this idea.

Although many workers (Jacobson, Frost & King, 1966; Markous, 1966; Nash, 1969, 1971; Novomeysky, 1965; Youtz, 1966) support the hypothesis of that human fingers might be able to detect radiation, all studies exhibit methodological problems. In Nash's and Novomeysky's studies, their methodological problems are as above. It was not clear if the experimenter was ignorant of the targets used in Jacobson's study. In Markous's study, only three of six participants used an aluminium box to prevent peeking. Youtz has not yet published a full account of his work, though he did use a blindfold as a safeguard. Again, they all did not provide fully detailed information of the experimental process and safeguards.

This hypothesis has not been proved. Presumably, we need to investigate whether this finger-reading effect is measurable, then it could be appropriate to explore the basic properties of it in order to develop assumptions or theories to explain it.

Future research

The finger-reading effect has never been proved. To solve this problem, the answer is simply to run finger-reading experiment under well-controlled conditions. The authors suggest adopting the paradigm originally developed by Si-Chen Lee to further explore this finger-reading effect, which now has been modified and is being tested by the authors.

The finger-reading procedures are developed from Chinese culture. One might ask whether it can be applied in Western culture? Needless to say, no studies of this issue have been undertaken. To answer this question, the authors would initially make the assumption that ESP might be an ability common to all humans. It is a good strategy that researchers observe what is going on when finger-reading studies are conducted in Western society.

If the finger-reading effect is true, the assumptions would be as follows:

1. Our fingers might be able to detect printing with a very low elevation, even a nearly zero elevation, probably through unknown functions in the fingers. This would be a new and astonishing discovery about sensory abilities.

2. The finger-reading effect might involve some new means of perception beyond those presently understood.

3. In fact, no one has produced any plausible or satisfactory explanation for the finger-reading effect or any new means of communication. The most difficult aspect is whether to attribute it to the first assumption or the second assumption. This effect might involve *both* exceptional tactile ability and some new means of communication.

With regard to the assumption one, the limit of relief recognition needs to be assessed first. For example, the finger-reading task used in Lee's studies was ink-printed text, which is in a range of 1–20 microns (.001–.02 mm in elevation). Usually, the paper absorbs most of the ink. One might expect that this ink-printed text is near zero in elevation. However, the true elevation of the text still needs to be precisely determined. To our knowledge, the relief recognition task and Braille reading are the most similar to this tactile touching task in finger-reading studies. In a previous study, an elevation of .5 mm has been shown to lead to correct recognition of letters in normal sighted adult people (Vega-Bermudez, Johnson, & Hsiao 1991). However, there are no studies of recognition using printed text and rarely have studies been conducted on the limits of relief recognition. In other words, the elevation between .49 mm and zero has not been explored so far. But there is some evidence that people may have abilities within this range. Braille characters are a good measure for spatial acuity, because they have been devised to assess the ability to resolve fine spatial form (Craig & Johnson, 2000). It was proposed that Braille pattern recognition is based on shapes outlined by the dots (Loomis, 1981), which can be considered as a relief recognition. One previous study has shown that normal sighted people can distinguish Braille patterns of .3 mm in elevation, while people who are blind from an early age can identify Braille patterns of .2 mm in elevation (Grant, Thiagarajah & Sathian, 2000). Assuming that Braille pattern recognition is similar to a relief recognition, the authors hypothesise that a relief recognition of .3 mm may be discovered. The authors are currently testing these hypotheses. It is vital to explore the limits of relief recognition since the results of these experiments will serve three important functions. Firstly, the limits of the tactile recognition of alphanumeric figures can be determined, as previously research has concentrated only on the recognition of Braille figures. Secondly, the value below threshold of tactile relief recognition will be applied to produce the touching samples used in later experiments, with the aim of ruling out the possibility of tactile cues. Finally, it can be regarded as a control experiment comparing the later finger-reading training experiment, since the former experiment will not involve any training procedures.

Any new sensory function of fingers or a new means of communication will need to be reconsidered and further explored, if fingers identifying printings with an elevation much below threshold is found in later research. If it is real, further investigation into underlying mechanisms can be done later, as studying it can tell us about exploring exceptional performance and how to enhance this. Theories might then be developed to account for the finger-reading effect.

In summary, the authors suggest that the limits of tactile relief recognition needs be determined. The finger-reading ability needs to be further explored under well-controlled conditions, especially in children.

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