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Research Paper

A Forensic Psychological Study for Detection of Deception in Financial Fraud Calls on Layered Voice Analysis (LVA^{Tm})

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ABSTRACT

The most basic communication medium among humans is oral communication. While talking, humans share not only the content of the information via their language, dialect, and meaning but also their emotions regarding any given situation. These human emotions ranging from enthusiasm to stress to guilt can be detected in a forensic setup using the technology of layered voice analysis. Layered Voice Analysis (LVA) technology is a sensitive and reliable voice analysis software that detects psychological parameters through analysis of voice. In this research paper, 12 samples of fraud calls are analyzed using the LVA technology for deception detection. The online scams using telephonic conversations to lure the victims into sharing their bank details, OTP, PIN of credit/ debit cards, remote access to their devices, etc. have increased over the years and the lack of awareness of such crimes and their detection has become obvious. The authors of this research paper aim to increase the awareness of the prevention guide for online scams and establish a sensitive, resourceful technology for the detection of fraud in many cases. The technology of LVA can be utilized in deception detection to differentiate a genuine call from a fraud call, in online as well as offline (recorded) set-ups. This can moreover help the judicious and timely process of justice.

Keywords: *Forensic Psychology, Layered Voice Analysis (LVATM), Financial Fraud Calls, Crime and Justice, Detection of Deception*

Human oral communication includes not only the linguistic, meaningful content that the speaker conveys to the listener(s) but also all the aspects of indexical information of the speech signal (Tiwari, 2012). The identity of a speaker, a speaker's age, lucidity and consciousness, their language and dialect are all included in the indexical information of the speaker's voice. Apart from the physical parameters, human emotions including stress, guilt, etc. are all included in the voice pattern of the speaker. The presence of

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high emotional stress with higher cognitive function may constitute deceptive content. Lying/ deception has a general relationship observed with the acoustic stress which would be identifiable in most of the cases. Few exceptions of deception detection using the acoustic parameters may be observed in sociopathic individuals or individuals with chemically muted stress (Martin, 2013). However, in a majority of cases, substrata of deception can quite easily be detected due to the psychological stress observed in speech and vocal parameters.

For over 30 years, commercial products purporting to measure the acoustic correlations of deception and psychological stress have been marketed to forensic institutes. The successful applications of the instruments for the effects of psychological stress have been observed by both law enforcement and national security agencies. Forensically, the statements of claimants, witnesses, or suspects can be dealt with such voice dependent deception detectors to find whether or not an individual is being deceptive in its statements or is providing incomplete information (James D. Harnsberger Ph.D., 2009). Apart from that, certain instruments of voice analysis run audio recordings of speech to assess the physical and/ or psychological parameters of voice. Covert monitoring of speech of individuals can also be established by this action and can be of immense help for investigators.

The Layered Voice Analysis that is also known as LVA technology is one of the most popular technologies utilized in deception detection using voice fluctuations to detect psychological stress (Nemesysco, Voice Analysis Technology, 2019). The Layered Voice Analysis technology is advanced machinery. It is a competent piece of machinery with complex algorithmic measurements that help in the detection of human emotional levels. Even the emotional stress hidden beneath voice tempo can be easily uncovered. The LVA is highly sensitive and able to discover even a slight change in the pitch of the spoken words of whosoever is speaking those words. A computerized LVA technology was invented by Amir Liberman in 1998 (Speech Analysis, 2012). A patented set of voice parameters are used in different combinations of human emotions. These various sets of algorithmic combinations are utilized to detect deceptive intentions in crime-solving capacity. The technology of LVA makes note of stress levels, cognitive functions, emotional reactions, and SoS (Say or Stop) criteria for a deeper understanding of the mental and emotional state of an individual at any specific segment of time. In this study, the recording audio files available on the internet were run through the software. The speech patterns throughout the conversation were automatically calibrated by the instrument to obtain a baseline of the speaker's speech pattern. Throughout the recording, it could be observed about which segments were important to the speaker, the ones where the speaker was emotionally unstable, cognitively active, excited, confused, or having a presence of guilt complex. The software focuses on the irregularities in the speech flow rather than the content or the linguistic characteristics of the individual. Based on the irregularities and the patterns observed from collective research on a grand scale by Amir Liberman in 1998, the initial computerized Voice Analysis System was invented. After extensive research of 20 years, the current computerized system was developed. Through further research and experimentation, LVA also established 9 patterns of deception that are observed most generally in the population around the world. The 9 patterns of deception are as follows: 1) P1- Extreme Tension, 2) P2- Extreme Cognitive Stress, 3) P3- Extreme fear and Stress (SOS driven), 4) P4- Controlled Voice/ Embarrassment, 5) P5- High tension and Low thinking, 6) P6- High "Rejection: (FRG) & Fear, 7) P7- High "Rejection" (FRG) & Excitement, 8) P8- High "Rejection" (FRG) & Conflict, 9) P9- High "Rejection", abnormal fear, excitement and conflict.

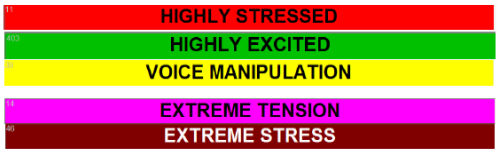
LVA can be used in two modes- Online and Offline Modes (Chowdhary, 2021). In the present study, the offline mode was utilized to run the recordings of fraud calls selected from online platforms. The software analyses every segment of the recording and substantiates the psychological parameters of the vocal feed. Based on the parameters, the software provides color-coded messages based on the risk assessment of deception as follows (Ltd.):

- Level 1

  Emotional messages

- Level 2

  Intensive emotional reaction messages



- Level 3

  Risk messages

These segments are further evaluated by the software to reach a conclusive decision based on an average of all the relevant segments selected by the examiners. The conclusive decision can be any of the follows:

1) High Risk was detected in a relevant issue- signifying that the responses could be that of the ones made by a deceptive person.
2) Inconclusive results in relevant questions- signifying that a conclusive decision could not be reached regarding the relevant issue.
3) Low Risk was detected in a relevant issue- signifying that there is a high probability that the speaker is not deceptive.

The inconclusive decision in the relevant questions could be due to the following reasons:

i) Lack of relevant data.
ii) Poor frequency data could not be analyzed.
iii) Requirement of more data from the interviewee regarding the incident/ relevant issue.

The digitization of several routine tasks like booking appointments, making payments, shopping for groceries, ordering food, etc. has led to a person's continuous online presence. Reflexively, the thieves, fraudsters, robbers, and personal attackers have also gone online. Online transactions have led to a different field of cyber-crimes wherein fraudsters pretending to be customers, customer support care from the bank, online payment segments, or friends via the internet attempt to dupe individuals of their money. Online digital payment sites like Google Pay, PhonePe, PayTM, etc. along with OLX, Amazon, and other sites for online transactions have become the hunting ground for fraudsters. In many cases, the fraudsters approach via telephonic means to enable the victims for the bank details, OTPs, or QR code payments which enable them to credit money into their accounts without approval from the victims.

Some cyber frauds (Rathod, Gaur, Parihar, Kumar & Jain, 2021) that are popularly extensive via telephonic conversations are:

1) **Bank Frauds:** The victims are approached by the imposters with random, most promising scenarios. The imposters mostly pose as bank officials. They employ common plots like the victim receiving a new debit card or credit card, depositing money in the bank account for a certain lucky draw, or bank offers. The fraudster asks for a One Time Password (OTP) from the victim's mobile phone to allow the transfer of money. Victims had a lot of their money directly transferred from their bank accounts to the bank account of the fraudster. The victims lost all their money without any identity of the fraudster or any way to track the imposter back.
2) **Ponzi scheme:** A Ponzi scheme is a sort of deception in which con- artists deceive victims into believing that money from newer investors is being utilized to pay gains to older investors. Victims are led to believe that profits are made by legitimate corporate activities (e.g., product sales or successful investments), when in fact, the money is coming from other investors. A Ponzi scheme can maintain the appearance of a profitable business as long as new investors contribute new money and the majority of investors do not demand full repayment and believe in the non-existent assets they are supposed to hold. This is a pretty conventional type of scam, but nowadays, fraudsters are increasingly exploiting the internet to entice victims in.
3) **Paytm/Google Pay/Phone Pay/UPI Payment Fraud:** Any random scammer can approach a potential victim with enticements to a lucky draw prize, payment for a purchased item (which is not essentially existing), payment in receiving for any item on sale, etc. In case of unaware victims, they accept the offers as professed and share their bank details, QR code, PIN, or OTPs to the fraudster on the phone. The phone is then disconnected and the number of the fraudster becomes inactive. The money gets debited from the victim's account and gets transferred to the fraudster's account.
4) **Identity Theft:** Identity theft is stealing another person's personal or financial information to conduct fraud using that person's identity. The person impersonating to be somebody else makes illegal purchases and transactions on the stolen identity and the balance from the real person's bank account are deducted. The term 'Identity Theft' was coined in the year 1964 and it occurs when a person uses another person's name, social security number, or credit card number without their permission for personal and financial gain.

In this research paper, the main aim for the authors was to analyze known fraud audio files on the software of LVA technology to establish the falsehood/ deception in the calls that are usually made by imposters claiming to be from banks, online website customer care, or customer support of various digital payment platforms.

METHODOLOGY

This study provides a qualitative analysis of the types and numbers of fraud calls received as a result of using the digital platforms for payments, purchases, offers, etc. Different online platforms were searched and 12 samples were selected using purposive random sampling method from the social media platforms i.e., YouTube and Facebook. These samples were opted based on the content of the call, clarity of the speakers, and low amount of background noise.

The selected samples had aware individuals addressing the calls expertly to make the fraudsters talk for a long time (as much as each caller could be enticed). The individuals

tempted the speaker to continue the conversation to an extend where they interacted with confusion and pretended to be gullible. A brief note on each recording is provided below as to the focus of the conversation, the length of the conversation, and the number of relevant segments found in a conversation where the fraudster lied:

Sr. No.	Brief of the Recording	Length of the recording (mm: ss)	Number of relevant segments selected
1.	The fraudster pretending to be PayTM customer care tried to lure a potential victim (PV) into accepting false lottery money won by the PV. He offered a certain amount of money that could be directly transferred to the PV's bank account or PayTM wallet. In that, he kept sending a request of accepting a debit of a certain amount from their account. Here, the PV went along with the ploy till sounding the false alarm of losing money and employing confusion as a weapon.	03:25	37
2.	Mr. R approached an imposter pretending to be an Army officer on Facebook to purchase a scooter from him. As a pretext of asking for transport expenses for the scooter and deducting the amount of same from the deal later, the imposter asked Mr. R to digitally transfer a certain amount to him. Mr. R pretended to buy the explanation and sent false screenshots of the digital money already transferred.	12:56	113
3.	A blogger approached a number that had successfully taken INR 5000 from his mother. The number was of Paytm customer care for KYC verification and updating. The blogger called and talked with the fraudster regarding the renewal of his KYC and after emptying his Paytm wallet also gave access to his mobile device to see how the fraudster would act.	11:11	28
4.	A fake friend pretending to be a known person called one potential victim (PV) randomly and asked him to share his Paytm login to get money from a third party into the PV's account. The 'friend' demanded that PV share his PayTM login details with him so that money could be transferred into PV's account.	04:21	39
5.	An imposter pretending to be from the customer care of KBC approached a potential victim (PV) on WhatsApp via a	17:28	58

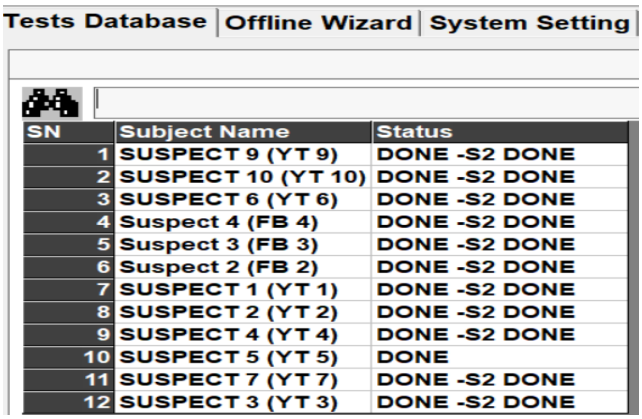
	pre-recorded audio message claiming that the PV has won a lucky draw in KBC. After talking to the relevant person on WhatsApp again, the imposter asked for a certain amount of money to be transferred to the number he was calling from. The money being asked for was an online tax which would be transferred right back to PV in 5 minutes along with the lucky draw amount.		
6.	A fraudster pretending to be from PhonePe customer care approached a potential victim (PV) who required some amount to be refunded as the money had been cut from his account but had not reached his friend's destination account successfully. The fraudster tried to lure PV into believing that the amount section would signify a QR code and that the amount would not be cut from his account as a refund note was attached below in the description.	12:37	114
7.	A con artist pretended to be a purchaser looking to buy a TV device from an OLX advertiser alias potential victim (PV). After talking about the TV for a while and approving the sale, the con artist simulated to play-acted as if to pay the entire amount to PV by sending a scannable QR code to the victim to "accept" the money from the purchaser by inserting the PIN.	10:03	59
8.	Sometimes, when Google Pay takes time in processing the payments, the customers usually call the customer care number for help. Fraudsters have set up a fake website with their numbers so that an unaware population may call their numbers and fall prey to their trickery. The potential victim (PV) approached one such fraudster via call. The fraudster tried to make PV accept the refund address by matching a nine-digit number that would have emptied PV's bank accounts.	12:06	31
9.	An impersonator from the customer care of PhonePe approached a potential victim (PV) for a reward from the PhonePe company. As a reward certain amount needed to be accepted from the	12:27	53

	notification icon and by entering the UPI Pin of the account on the request of reward link received by PV. If the following steps are followed, the reward money shall be "added" to PV's PhonePe account.		
10.	This recording was a completely different type of conversation wherein the potential victim (PV) approached a fake customer care number and introduced himself to the number as a fraudster. Here, he took out details from the fraudster to learn and understand the sequencing from approaching any potential victim to laying the bait to rejoicing in the money intake.	09:09	17
11.	A potential victim (PV) was approached by a purchaser for a bike he had uploaded on OLX. When the purchaser decided to buy the bike without looking at the bike at all and offered to pay money for the same, PV approached the matter cautiously and recorded the conversation. The purchaser sent links to the digital payment platform to receive money and expected PV to accept the proposal for the payment.	06:30	36
12.	An impersonator from Amazon customer care approached a potential victim (PV) with an offer of a cashback on a recent purchase of a Samsung Mobile Phone whose purchase details were known by the impersonator. While the impersonator tried to send out links to PV to accept the cashback, she kept playing with the words to make PV write his UPI pin and send the money from his account.	07:27	37

NOTE: The term Potential Victim (PV) is utilized for each recording individually in each row. The term signifies callers who were either approached by the fraudsters or approached the fraudsters with intention of recording them live in the act.

Analysis

The samples that were collected from the YouTube and Facebook sites were downloaded in mp4 format i.e., it had a video format. A total of 9 videos were downloaded from YouTube and 3 were taken from Facebook. Using an audio converter, the videos were converted to audio files in .wav format which is supported by the LVA software. A database was created for the analysis of the selected samples and the same were run in the software.



Tests Database | Offline Wizard | System Setting

SN	Subject Name	Status
1	SUSPECT 9 (YT 9)	DONE -S2 DONE
2	SUSPECT 10 (YT 10)	DONE -S2 DONE
3	SUSPECT 6 (YT 6)	DONE -S2 DONE
4	Suspect 4 (FB 4)	DONE -S2 DONE
5	Suspect 3 (FB 3)	DONE -S2 DONE
6	Suspect 2 (FB 2)	DONE -S2 DONE
7	SUSPECT 1 (YT 1)	DONE -S2 DONE
8	SUSPECT 2 (YT 2)	DONE -S2 DONE
9	SUSPECT 4 (YT 4)	DONE -S2 DONE
10	SUSPECT 5 (YT 5)	DONE
11	SUSPECT 7 (YT 7)	DONE -S2 DONE
12	SUSPECT 3 (YT 3)	DONE -S2 DONE

Figure 1: The database of 12 samples as created in the software

Firstly, the segments created in the LVA software were transcripted in the software to easily locate the relevant issues to be marked in the software.

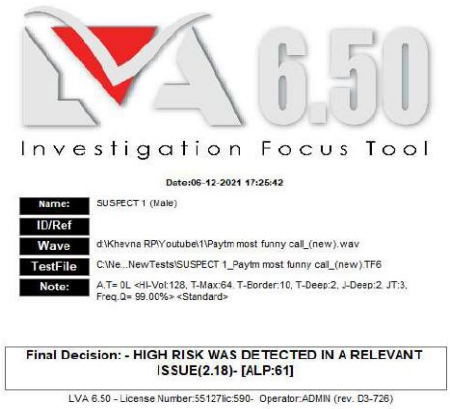
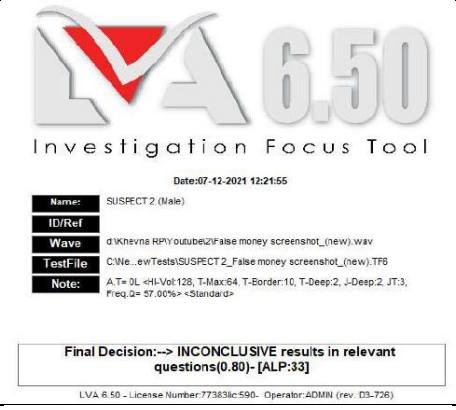
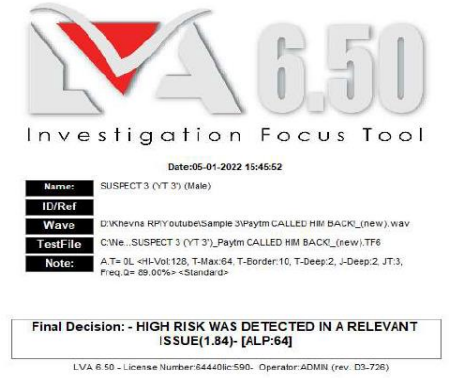
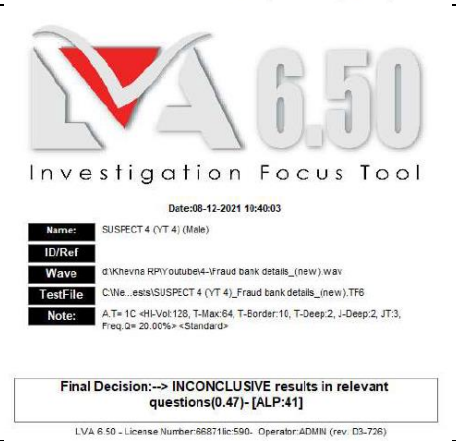
No.	Issue
11	'Kitna paisa tha sir?
12	'kab kiya tha
13	'aaj din ko na, kaun si bank link hai sir?
14	'Sir, aap google pay se kiye the ya phonepe?
15	'Registered number nahi hai aapka, sir?
16	'Toh, sir kaun sa link bank link hai aapka?
17	'google pay mein?
18	'Axis bank na?
19	'Ji 10 hazar transaction karne se pehle
20	'sir aapka payment successful hua tha?
21	'fail hua tha ya processing mein tha?

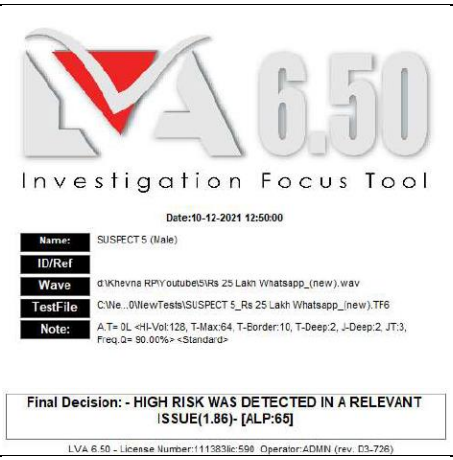
Figure 2: An example of a fragment of segments and their transcripts

Furthermore, after the wholesome segments were heard again to make sure the transcriptions of the segments were correct, relevant segments were selected by the examiners. Once, the examiners were certain of the completion of the task, the data was finalized and results were generated in the software. The report/ result obtained from each recording is briefly provided in a tabulated format in the subsequent segment.

RESULT

The online fraud calls that were analyzed using the software of LVA technology were of various lengths- ranging from 03 minutes 25 seconds to 23 minutes 45 seconds. Regardless of the lengths of the recordings, the following results were obtained:

Sr. No.	Name of the Recording	Results as shown by the software
1.	Sample 1	
2.	Sample 2	
3.	Sample 3	
4.	Sample 4	

5.	Sample 5	
6.	Sample 6	
7.	Sample 7	
8.	Sample 8	

9.	Sample 9	
10.	Sample 10	
11.	Sample 11	
12.	Sample 12	

The ALP or average lie probability values here are a general credibility score of the result. It is also known as the Global Honesty Rate. The recordings/ conversations and their subsequent links with detection of deception were more dependent on the content of the conversations. It was not dependent on any of the below-

i) The length of the conversation.
ii) The number of relevant segments.
iii) The gender of the speakers (as a baseline for different genders is processed during analysis).

DISCUSSION

India experienced a high online fraud encounter rate in 2020 according to the Microsoft 2021 Global Tech Support Scam Research report. Around 69% encounter rate was observed in the year 2020 (More Indians fall prey to online fraud, millennials suffer the most, 2021). Out of that, 31% of Indians (the highest percentage globally) also fell victims to such frauds and lost money in different scams.

Most of the financial crimes that are committed on the online platform/ cyber grounds fall under the category wherein a criminal is an opportunistic and serial fraudster working individually or with a group of people who randomly approach victims on online platforms. Over the two years, times have changed with the Covid-19 situation as well. Online transactions have also increased due to increased online work and a significant increase in shopping and purchases digitally as well. An 8-point increase in fraud occurrence has been observed over the years 2018 to 2021 (ABP Live, 2021). Moreover, it was observed that in recent years, people from 24- 37 years are widely targeted and about 68% of these people have lost their money in online scams. However, people of all ages are targeted, usually, the elderly and teenagers with access to the facilities/ devices but lack of awareness were more likely to fall prey to such crimes.

The general unawareness of the public regarding the types and methods of online fraud occurring in India is the core concern. The public must be made aware of the fraudulent ways of the imposters to filter fraud calls from genuine calls. The basic documents access information and details required to be shared based on the requirement of the service needs to be informed to the public. Certain key points that can help prevent online fraud are as follows (India Today Web Desk, 2019):

1) Do not believe in unknown chats, screenshots, information, advertisements, or bulletin.
2) Do not share your details like your date of birth, full name, location, or address with strangers.
3) Do not share bank details like the account number, OTP, or credit card details.
4) Use strong passwords, PINs, and patterns to lock your digital applications, especially your digital payment applications and bank applications.
5) Do not be greedy as no benefit comes without interests.

If such scams have already occurred with you or anyone near you, reporting the crime is essential. Approach the nearest Police Station and file a First Information Report (FIR) at the local police station. In case of availability of cyber cells in the state, approach the Cyber Cell Division and register Cyber Crime FIR at the division. Indian Government has also started setting up helpline number 155260 which is manned and operated by the state police officers. Currently, Chhattisgarh, Delhi, Madhya Pradesh, Rajasthan, Telangana, Uttarakhand, and

Uttar Pradesh have attained the functionality of this helpline. Reporting such scams is an essential step in fighting the ever-increasing online and telephonic scams.

CONCLUSION

The LVA technology is the most effective analyzer of human emotions using the vocal parameters. For further analysis and deeper examination into the online scams, a greater number of fraud calls can be run through the LVA software for a better percentage of analysis and establishing a more equal gender divide in the samples. Moreover, the samples can be directly collected from people such that the clarity of the recordings and lack of background noise can be checked before the selection of the samples.

A large number of online scam cases remain unreported in India. One of the basic reasons for victims not reporting the cases is that the victims are unaware of the places to report online scams and also that online scams are punishable offenses under the Indian Penal Code, 1860 and Information Technology Act, 2000. Moreover, a layer of personal shame and guilt on being taken advantage of creates a fear of humiliation in society due to which an individual avoids bringing said scams in front of the public or reporting the same. Additionally, online scammers are tricky and cautious in their scams by transferring only small amounts of money from a lot of people rather than a huge amount from fewer people. This keeps them inconspicuous while at the same time providing the victim with a feeling that the loss is insubstantial in the longer run. This unsubstantial loss of money also provides the victim with a calculative instinct with the judicial process. The amount of time and cost that the victim would require to file a complaint, follow up on the process, and fight for justice may become greater than the money lost in the scam. Lastly, it is also observed that such small-scale scams have been normalized and taken in stride as repartee for conversations. The commonness of occurrence has made these scams less threatening and more ordinary.

Studying the escalation in the rate of online scams through the past years, such scams must be taken seriously, reported, examined and justice served. To enable this Government of India has set up various Cyber Cells in many states. Along with that, the Central Forensic Science Laboratories (The Hans India, 2019) in India have started Forensic Psychology Divisions with instrumentations and technologies to help in psychological investigations of the crime in a sound and expedient manner.

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Conflict of Interest

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