Journal of Parapsychology
2019, Vol. 83, No. 2, 232-247

http://doi.org/10.30891/jopar.2019.02.08

Effects of Mood and Emotion on a Real-World Working Computer System and Network Environment[1]

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Abstract. This study used a custom computer system designed to induce anxiety in participants and determine if people who are anxious produce more errors in an independent working computer network. Participants (*N* = 130) were asked to complete sixteen tasks on a computer in twenty minutes to receive a reward. Each participant self-rated their anxiety levels during the tasks. In addition, 130 sessions were run without a computer operator. The network ran independent of the tasks, and operated continuously during the sessions. The first hypothesis predicted sessions without operators would produce fewer network errors than sessions with operators, but it was not supported (*p* = 0.35). The second hypothesis predicted that anxious operators would produce more errors on the independent network than those less anxious. Initial analysis indicated an unsupported hypothesis, but the initial design did not properly identify anxious users. A post-hoc revised grouping based on actual reported anxiety resulted in this hypothesis being supported (*p* = 0.04, *d* = 0.45) indicating that anxious computer operators may affect network communication. There may be other electronic effects as a result of human emotions. Additional research is necessary to confirm these results and explore whether the intensity of emotions affects electronics.
Keywords: electronics; emotion, network; signal fault; mind-matter interaction; PK

Since 1970, a number of studies have been published indicating that, through focused intention, people are able to create an electronic disruption or have an influence on electronic systems or quantum processes (e.g., Jahn, et. al. 1997; Morris, 1986; Radin, 1990; Schmidt, 1970). Unintentional effects on larger objects have been observed in reports of apparent poltergeist activity, but instead of the activity being attributed to a mischievous spirit or disruptive ghost, these formal investigations have focused on unintentional effects produced by human agents who are regularly present when the activity is observed (Pratt & Roll, 1957). Numerous investigations have reported unintentional effects on physical objects, like photographs, blankets, trinkets, or bottles (e.g. Palmer, 1974; Roll & Storey, 2004), but other times the effects are observed on electronic devices and phone systems (Kruth & Joines, 2015). Some of these investigations have presented indications that anxiety and stress contribute to the demonstration of these unintentional events (Kruth & Joines, 2015; Pratt & Roll, 1957; Roll, Burdick, & Joines, 1973, 1974). The previous studies lead to the proposition that unintentional activity may influence electronic systems and that this activity may be exacerbated by stress and anxiety.

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A study by Broughton and Perlstrom (1986) explored the performance of study participants playing a Random Number Generator (RNG) based computer game that measured the effect of intention and focus by the participants. The study included a measure of self-reported anxiety and questions related to the practice of a mental discipline. It focused on performance in intentional tasks in which participants were trying to win a computer game with focused intention. The only significant finding was a negative correlation between higher anxiety measures and the intentional tasks. In other words, when the participants were more anxious, they appeared to affect the RNG in the direction opposite to their intention. Anxiety caused them to lose the game, which the authors interpreted to be the result of an unconscious block or masked desire to avoid having the stated effect.

A field investigation by Kruth and Joines (2015) reported consistent electronic disturbances and signal interruptions on telephones, electronic locks, computers, computer networks, and printers. These events only occurred when a specific 11-year-old boy was present. The study also indicated that the disturbances were reduced and eventually stopped after the boy learned to reduce his anxiety using simple stress reduction exercises.

Anecdotal reports by people who have had Near-Death Experiences indicate that a fairly common aftereffect of a Near-Death Experience is unusual activity by electronic equipment (Atwater, 2007; Fracasso & Friedman, 2012; Knittweis, 1997; Nouri, 2008). Despite a significant number of anecdotal reports, no known published laboratory reports have tested these effects. That is, there are no known published reports on the effect of human emotion and moods on the operation of computer systems and networks in a real-world working environment.

The goals of this study were two-fold. The first goal was to create a monitored computer system that would detect unintentional effects on the system and network stability. The second was to examine the effects of human emotions and moods on the operation of computer systems and networks in a simulated working environment. If human moods and emotions have an effect on the system, it is an indication that unintentional electronic interference may result from certain emotions, and they may be causing some computer and network malfunctions in real-world environments.

A custom computer system and network was created and the system was monitored for errors while a sample of computer operators performed timed computer tasks in a stress-induced environment. An experimental group was purposely frustrated in their tasks by inoperative software, while a control group performed the task without interference. The system was also run without operators to produce a final no-operator control condition for the system operations.

The two hypotheses for this study were exploratory in nature. The design was registered as fully specified, including the analysis techniques, in order to provide the most thorough review of hypotheses based on the study design:

H1: Computer operators can have unintentional effects on the electronics of computer systems and network connections, and these effects will be reduced when the computers are running automatically, without operators.

H2: Anxiety and stress evoke unintentional effects on electronics and networks, and computer operators under greater stress will demonstrate more software and network errors than operators in a less stressful environment or an environment that does not require a computer operator.

Method

Sample

The sample consisted of 130 participants, 65 in each group, including 89 who self-identified as females, 39 males, and two who identified as other genders. The age of the participants ranged from 18-75 years with a mean age of 47.6 years. The sample participants were obtained through electronic and paper advertisements, mostly distributed by hand in the neighborhood and town around the research lab or at a nearby university. Groups were determined using an automated randomization process. Neither the experimenters nor the participants were aware of the group assignments. Masking was maintained throughout the analysis process to avoid any unintentional influence on the data analysis. Participants were informed that they were taking part in a parapsychology study exploring the interaction between people and computer systems. No additional details were provided to participants to describe exactly what was being measured or how the data were being collected until after the study was completed. None of the participants were queried about their beliefs or expectations related to the study. The Institutional Review Board of the Rhine Research Center gave Ethics approval to this study.

Procedure

Two standard commercial desktop computers (Lenovo Model K450E) were networked in a peer-to-peer system utilizing custom software performing standard operations and communicating using standard networking protocols. Each session consisted of four activities.

1. Computer operators interacted with custom software on computer #1. This user interactive software provided instructions to the participants and asked them to perform a series of tasks on the computer in a limited amount of time (20 minutes or less).
2. Computer #1 continuously sent data to Computer #2 throughout the session. These data were not related to the activity being completed by the participants, and was not affected by the software used by them. (See section below on *Isolation of Software Processes*.) The participants had no knowledge of this network communication and did not have any direct interaction or effect on the data being transferred between the computers.
3. Testing and error checking software was run on both Computer #1 and #2 to monitor the network communication for errors and log all activity and errors detected in the network communication.
4. Participants self-assessed relaxation and anxiety before and after the interactive sessions to provide an assessment of the change in anxiety or stress experienced during the session.

Participants were provided with an identification code and log in information before they began the study, and were told that if they completed the tasks associated with the study in less than 20 minutes, they would receive an award of a gourmet chocolate bar and an entry in a raffle for a $200 gift card. The rewards were selected to motivate the participants to complete the tasks.

Each participant in the study was assigned to Group 1 or Group 2 by a random selection process performed by the computer system at the moment that the participant logged in to begin the session. Group 1 was presented with a series of timed tasks to perform on the computer, and the user interactive software presented to this group operated in a normal manner, enabling the tasks to be completed with a series of simple operations like button pushes, matching photos, moving items with the mouse, locating hidden images, and typing in text fields. See Appendix for details of the tasks that were completed by each participant.

Group 2 received the same instructions and tasks as those assigned to Group 1, and the user interactive software looked exactly the same as the interface used for Group 1. Group 2 was instructed to perform the same timed tasks, but the software used by this group purposefully introduced malfunctions and errors into the process. For Group 2, button presses sometimes malfunctioned on purpose, text fields did not immediately accept input from the operator, items were hidden longer, or additional delays were introduced by popup dialog boxes or software pauses. The purpose of the malfunctions was to induce a sense of urgency and to increase the stress and anxiety experienced by the participants while completing the computer tasks. Group 1 was the control group and Group 2 was the experimental group.

While the software tasks were being performed on the client computer by the participants, a constant stream of data was sent from computer #1 to computer #2 via an isolated, hard-wired peer-to-peer network. Because many of the modern networking protocols (like TCP/IP) include a significant amount of data checking and automatic correction, a specific networking protocol was used that does not perform error checking. This protocol is called UDP and is commonly used internally in telecommunication software processes. It is a very fast protocol that depends on the network software to perform all error checking and to handle all issues that arise during network communication.

During network communication, a predefined set of data was encoded, packaged, and sent from computer #1 to computer #2. On computer #2, the data were unpacked, reassembled, decoded, and written to the hard drive. Data integrity and reliability testing were integrated into the networking software. The results of the tests were logged and the number and location of the errors were recorded for each session.

At the beginning and end of each session, the participant was asked to assess their relaxation and anxiety levels on a scale of 1 to 10 - 1 being relaxed and calm and 10 being least relaxed; 1 being very low anxiety and 10 being highest anxiety.

Networking Software

The network communication software was run continuously throughout the study. Errors were logged for the communication process 24 hours a day whether sessions were being run or not. The network was designed to create an extremely sensitive system that would produce transient faults that could be detected regularly while the network was operating. In order to create a thin threshold for errors to occur in the system, the network communication process was tuned to produce transient faults or errors regularly by adjusting the number of messages sent between the computers. The number of messages sent between the systems was adjusted to produce a minimal number of synchronization faults, where the messages collided due to the speed of the network, while the network continued to produce errors due to other faults that were the result of other external influences on the network. (See *Common Errors on Computer Networks*) The optimal level to produce this effect was determined to include over 767 lines being sent every second between the two computers, producing errors nearly every day while the system was running. This resulted in an average of 339 errors per day, ranging from 0 to 3,799 in a single day.

Errors were recorded during each of the study sessions, and an equal number of sessions was randomly selected when there were no computer operators present. These no-operator sessions were used to determine the reliability and integrity of the network communication system without any human interaction and to test the first hypothesis (H1).

Common Errors on Computer Networks

Networking errors occur as a result of faults in the network system, and faults are typically classified as permanent, intermittent, or transient. Permanent faults usually are not resolved until a repair action is taken, for example a hardware failure or a disconnected network cable. Intermittent faults occur on a periodic basis and reduce the reliability of a network. Transient faults are temporary, and are usually corrected by error recovery software (Steinder & Sethi, 2004).

In a simple, peer-to-peer, hard-wired network, like the one used in this study, the most common faults would be transient unless there are specific hardware problems. Intermittent failures are more common in larger networks with multiple nodes or routers. Transient faults are most often the result of external interference, like electromagnetic interference (Cha et. al., 1996), high-energy particles (Normand, 1996), or attacks, or internal dysfunctions like design flaws or software bugs (Huang et. al., 2014). In addition, synchronization issues can produce transient faults until the temporal consistency is re-established (Steinder & Sethi, 2004).

The networking software in this study integrated fault detection and logging directly into the networking system. Since the data sent over the network was fixed and consistent, the fault detection software could be specifically designed and tested to eliminate internal dysfunctions and automatically log any other errors that occurred in the data transmission process. Because the network was isolated from any other computers there was no possibility of attacks, but faults could occur as a result of electromagnetic interference or high-energy particles. These intermittent data transmission errors were logged without regard to the specific cause of the interference.

Isolation of Software Processes

When running multiple software processes on a single computer system, questions arise about the isolation or interaction of these programs. In this system, the network software and the user interactive software were both running on a single computer. Could these processes have affected each other?

To isolate computer processing and avoid interaction between programs, the programs must first be run in different threads or different processes (Vokorokos, Balaz, & Mados, 2015). In addition, to avoid competition for OS resources, access to the resources must be controlled or the programs must not use the same files, network resources, locks, processes, CPU, among other resources (Liang, Venkatakrishnan & Sekar, 2003; Vokorokos, Balaz, & Mados, 2015).

The two programs used in this study were carefully designed so that they were not using the same files or processes, and they were run on separate OS threads. Only the networking software used the network resources; the user interactive software did not access the network. It could be argued that since the software programs were being run on the same computer that they were sharing CPU resources and one process was affecting the operation of the other process through competition for CPU time. In this case, neither program performed process intensive tasks or extensive mathematical calculations. The networking software specifically was designed to perform extremely simple tasks that only included accessing the file system, minor data processing, and network communication.

Even with these careful design considerations, it could be argued that having both processes run on a single computer could affect the results of H1 where the network integrity was being compared in conditions where the user interactive software was being run and other times when it was not. Given this minor possibility of interaction between the programs, the results of the analysis for H1 should be carefully considered before coming to conclusions.

Hardware Setup

The hardware consisted of two standard, commercially available PCs (Lenovo K450E desktop systems) running the operating system Windows 7. These computers were connected via a standard, hardwired networking cable, and neither computer was connected to any external network or the internet. Wireless capabilities were turned off on both computers.

Software Design

All of the software used for this study was custom designed and built. There were seven major software components: the controller software that ran each session, the user interactive software, the network communication software, the software that sent data across the network, the software that received data from the network, the test software used to determine networking reliability and data integrity, and the data logging and recording software.

1. The controller software: This software is the containing structure for the entire session. This software allows the participants to log in, randomly assigns them to an experimental group, starts the interactive software, and logs all data collected throughout the session.
2. User Interactive software (See Appendix): This software provides instructions to the participants and enables them to complete the timed tasks. There were two versions of this software, one for each group. The first version used by Group #1 included a series of tasks familiar to most computer users including typing text in text boxes, using the mouse to move items around, matching images, and finding hidden objects. This version worked as is normally expected of error free software. The second version, used by Group #2, looked identical to the software used by Group #1. The same instructions and tasks were provided in this version, but the user interface purposely contained mistakes and malfunctioning components. For example, buttons did not consistently respond to mouse clicks, text fields put the wrong text into the fields, intentional obstructions were included like built in delays or unnecessary popup dialog boxes. This second version of the interactive software was designed to induce anxiety and frustration in the participant using the software.
3. Network Communication Software: This component implemented the UDP network communication protocol for the network. It provided the mechanisms to read data, pack it for transfer, send data, retrieve data, unpack data, and write data to disk. This is standard networking software that is familiar to most network programmers.

4. Network Sending Software: This component read a predefined set of data from the hard drive and utilized the Network Communication Software to send the data across the network.
5. Network Receiving Software: This component accepted data from the network connection and utilized the Network Communication Software to unpack and read the data sent. It also wrote the data received to the hard drive.
6. Network Testing Software: This component was integrated into the network communication, sending, and receiving software. It checked each step in the data transfer and receiving process to confirm data integrity at each step. This component recorded all of the errors and logged the location and nature of each error. It also maintained a count of the errors at each checkpoint for each session.
7. Data Logging and Recording Software: This component maintained the data security and integrity for each session and for the study. The data logging and recording software was used by all components that wrote to the disk for each session.

Interaction with Participants

Only the author interacted with the participants before, during, and after the experimental sessions. He had a moderate belief that the study could produce results supporting both H1 and H2, but due to complete masking of the data collected and the grouping of participants, there was no apparent method that would enable the researcher to influence the opinion of the participants or their behavior during the sessions. Each participant was presented with a consent form discussing the nature of the sessions, but these forms did not include any information about the data collection technique or exactly what was being measured during the sessions. The participants were only instructed to complete the tasks within the specified time limit in order to receive the reward. Each participant was formally briefed by the researcher using the same language.

After the session was completed, the researcher interacted comfortably with each participant and provided debriefing information describing the nature of the software they were using and describing that there was a network running in the room during the session. Neither the participants nor the researcher knew the results of any individual sessions or how many errors were collected for any specific participant. This information was masked throughout the analysis process and continues to be completely masked. This was accomplished through an automated analysis process designed to avoid any knowledge of individual sessions.

Data Collection

The data evaluated in this study were the location and number of network errors, the group associated with each session, and the self-rating of relaxation and anxiety collected at the beginning and end of each session. Data for this study were automatically collected by the software programs. The programs automatically collected all of the network errors that occurred during each session. It recorded at which point an error occurred and how many errors occurred in each session. The program also associated the data with the group that was automatically, randomly assigned when the user logged into the session. Finally, the program collected and stored the response to the self-rating of relaxation and anxiety provided by each participant at the beginning and end of each session. Any data related to the users' performance on the mundane, user interactive computer tasks was ignored and was not collected by the program.

The saved data was stored on the hard drives of computer #1 and computer #2 which was only accessible to researchers associated with the study. Besides the data collected electronically, a separate record that associated each participant with a unique User ID was stored in a log book, separate from the computer data.

Performance Markers/Indicators

Data integrity was assessed by the testing program at different points in the network communication process. Data integrity was evaluated when the data were read from the hard drive on computer #1, when the data were prepared for transfer, when the data were about to be sent over the network, when the data were received on computer #2, when the data were unpacked on computer #2, and when the data were decoded and stored to the hard drive on computer #2. At each checkpoint, the number of errors recorded was tallied.

The markers used for evaluation and analysis were the total number of errors in a session, the number of errors at each checkpoint, and the location of each error. Due to the potential vulnerability of the data transmission process from Computer 1 to Computer 2, it was considered the most likely location to see variance in error data, so the count of errors found during the transmission of data was pre-defined as the primary analysis variable. Secondary factors related to reading, writing, packing, and unpacking the data were recorded but turned out to be insignificant to the process (see *Analysis* below).

Analysis

Data preparation

The log files for the sessions were combined with the log files from the network software that collected the number of errors that occurred on the system. Using the date and time of each session as a key, the network error log was queried to determine the number of errors that were recorded on the independently running network during each session. This information was separated into groups to further assist with the evaluation of the second hypothesis (H2) that participants who experienced greater stress (higher anxiety) would unconsciously affect the networking system to produce a greater number of errors than the control group.

The error data included records of errors when data were transferred between the computers over the networking system, and the packing and unpacking processes on the sending and receiving computers. While pilot testing the process, there were no errors detected in the processes of packing and unpacking the data on the computers. During the study, just as was the case during the pilot studies, errors were recorded in the data transfer process on the network, but no errors were found in the secondary processes on the sending or receiving computers. Since the primary analysis was related to the transfer of data (see *Data Collection* above), this was the only error data considered. The secondary factors measuring errors in the reading of the data, packaging of data, unpacking of the data, and writing of the data did not occur, so they were not considered in the analysis.

All calculations related to significance were processed using SPSS statistical analysis software.

To determine if the means between the two groups were significantly different, Levene's test was used to determine if the variance of the two groups were similar enough to conduct independent *t*-tests by taking into account the number of groups, and the total number of cases in all groups.

The effect size, *d*, was calculated using *Hedges' g* since the newly established groups were of different sizes. This effect size was corrected to remove a small bias to create an unbiased score using the calculation proposed by Hedges and Olkin (1985, p. 81).

$$g \cong d\left(1 - \frac{3}{4(n_1 + n_2) - 9}\right)$$

Results

The original experimental and control sessions were defined based on the groups that were using the different versions of the tasking software, and each group contained 65 participants. The experimental group used the software that included obstructions to induce anxiety, and the control group used the software that did not include obstructions. The experimental group was expected to produce a group that experienced higher anxiety during the session.

When the experimental sessions and control sessions were compared, the anxiety levels for the two groups were nearly identical. The experimental group had a mean anxiety difference of 2.35 while the control group had a mean difference of 2.36. The groups showed no significant differences in the number of errors detected (p = .96). Upon further investigation, it was determined that the experimental sessions, which were designed to invoke higher anxiety in the participants, did not produce a higher self-reported anxiety than the control sessions. This provoked further investigation.

The difference between the self-reported anxiety before and after the session was evaluated for each of the 130 sessions, regardless of whether it was a control or experimental session. Self-rated anxiety increased on average across all of the sessions with a mean difference of +2.35 on a 10-point scale. Only 24 of the 65 participants in the group originally designated as the experimental group had reported more anxiety than the mean value, while 17 participants of the 65 in the original control group reported more anxiety than the mean value.

A subgroup of all sessions was selected where the self-reported anxiety difference was greater than the mean difference for all the sessions (i.e. anxiety > +2.35). This group included 41 participants of the total 130 participants in the study (24 from the original experimental group and 17 from the original control group). This group was considered the group that experienced the highest levels of anxiety change during the session, and this group was redefined as the experimental group since it met the criteria for evaluating H2 (greater stress conditions).

The number of errors in the high anxiety sessions was compared with the sessions in which participants reported a smaller change in anxiety during the session. This included 89 sessions that were considered the control group where participants self-reported a change in anxiety at or below the mean change for all participants (i.e. anxiety <= +2.35).

The mean number of errors in the high-anxiety group (HI) = 12.20 errors per session. The mean number of errors in the control group © was 3.57. Levene's test for equal variances was used to compare the two groups and the variances were different, F (1, 128) = 12.39, p = .001. A comparison of means was evaluated with an independent sample t-test which indicated a difference between the groups, $p = .038$. Despite the significant difference in means, the effect size was small ($d = 0.45$), but the power of the results was moderately high (0.61) (see Table 1 for descriptive statistics).

Table 1

Anxiety Group versus Non-Anxiety Group: Descriptive Statistics

Group	N	Mean	Std. Dev.	Std. Err. Mean
Non-Anxiety	89	3.57	16.673	1.767
Anxiety	41	12.20	23.479	3.667

The first hypothesis (H1) predicted that there would be more errors detected in the network system when a participant was present than when there was no participant using the computer. To evaluate H1, all of the sessions for all participants (130) were compared with an equal number of sessions that were randomly selected as a "no-operator group" when the networking system was running unmonitored and no people were present in the room with the computers. The no-operator sessions were selected to compare directly with the experimental sessions. The no-operation sessions had the same duration as the experimental sessions and were selected at comparable times during the day. Some no-operator sessions were on the same day but at a different time than the experimental sessions, and some were at the exact same time but on days directly before or after the experimental session. The random selection was achieved with a query to the random number generator at www.random.org that produces a true random value. The random numbers indicated the hour for the no-operator session, and the minute within the hour and the length of the sessions exactly corresponded with each experimental session that included a participant.

The sessions that included a participant (SP) consisted of 130 sessions producing a mean of 6.29 ($SD = 19.41$) errors per session with a range of 0-126 errors per session and a standard deviation of $SD = 19.410$. The randomly selected no-operator sessions (SR) consisted of 130 sessions with a mean of = 4.17 ($SD = 17.30$) errors, with a range of 0-137. There was no difference between the groups, $F(1, 258) = 3.52$, $p = .35$. Besides self-rating anxiety, the groups also rated their level of relaxation change during the sessions. The relation between the level of relaxation and the number of errors recorded in the sessions was not significant, $F(1, 128) = 3.65$, $p = .32$.

Discussion

The study hypotheses predicted that human interaction with machines would have an effect on the number of errors detected in the operation of the computer processing and network communications. In addition, they predicted that participants who experienced greater stress (were more anxious) would produce more errors than those less anxious. It was predicted that the group that did not involve any computer operators would produce the fewest errors. Hypothesis 1 predicted that sessions involving participants would produce more errors in the independently operating network than random sessions where no participant was present. This hypothesis was not supported with equal groups that included sessions with participants using the computer and sessions where no one was in the room with the computers.

Hypothesis 2 predicted that participants who experienced greater stress (higher anxiety) would produce more errors in the computer network providing evidence that the mood of a computer user could have an effect on the operation of a computer network. The testing of this hypothesis was initially planned for testing with two equal groups of participants who were randomly assigned to use software specially designed to evoke anxiety in one of the groups. Participants who were in both the experimental and control groups reported anxiety at equal rates. Because of this, the grouping was modified to include participants who reported the highest change in anxiety during the sessions as the experimental group, and the remaining participants as the control group. This change in grouping resulted in 41 participants in the high-anxiety group and 89 participants in the control group, and the difference was significant. An analysis of the revised groups found a difference in the number of network errors detected in sessions completed by participants who experienced anxiety using a computer system and the sessions of those who did not. These results were supported by a small effect size and a moderate power for the study, and they met the criteria initially proposed as critical values for this study.

Recommendations

The experimental software was designed to induce higher anxiety in the participants, but participants self-reported higher anxiety in both versions of the software. It is obvious that the software differences in the user interactive software did not achieve the desired effect, but there may be another factor. Self-reporting can be unreliable, and it is possible that some participants might have under-reported their anxiety level or over-reported due to a lack of awareness of their emotions, a desire to suppress their own anxieties, or any number of other reasons. A better measure of anxiety could be achieved with physiological monitoring of the participants during the sessions to determine if there are any correlations between factors that indicate a change in mood (blood pressure, heart rate, skin conductance, etc.) and the number of errors detected in the network system. Other mood states could also be examined to determine their effects on the system.

Participants were motivated in this study with rewards that were designed to encourage them to complete the study within the 20-minute time limit, including a gourmet chocolate bar and a raffle for a gift card. Some participants stated that they were very excited to win the rewards, especially the chocolate, and wanted to complete the tasks on time, but others actually stated that they did not care about the rewards at all and were not in any hurry to finish. This variation in motivation seemed to have an effect on the anxiety levels experienced by the participants, and more significant rewards might have made the original experimental and control groups more likely to be influenced by the user interactive software.

In addition, selecting participants with similar computer experience or expertise would provide a more evenly distributed sample. In this study, some participants completed the sessions in 10 minutes while others took over 90 minutes to complete the same tasks. Despite this difference in time, the participants' self-reported anxiety difference did not correlate with the amount of time it took to complete the tasks. This suggests that some participants have little or no interest in completing the tasks to receive the reward while others are highly motivated. Ideally, this study would have included highly motivated participants to encourage the completion of the tasks in the specified time while evoking an emotional response when their progress was obstructed.

Finally, the predefined critical values and success factors for this study may have been overly optimistic in requiring an effect size $> .2$ and a power $> .5$ with a significance level $p < .05$. It is clear that a study that explores unconscious effects on a working computer network may produce a very small effect size. Also, unless there is a very large sample planned, the power is likely to drop below 0.5. Future studies of this type should consider reducing the predicted effect size to $d > 0.1$ and the sample should be increased significantly to provide a higher powered study.

Conclusions

This exploratory study provides preliminary evidence that the mood of the participants can produce an unconscious effect that will result in more errors in a computer system. With a more specific method to rate the mood of the participants, more pre-qualification of participants, and a larger sample size, future studies could shed additional light on these hypotheses and determine if this effect is strong enough to merit additional applications.

For example, as these findings suggest that computer operators may affect network communications when they are experiencing higher anxiety or frustrations, businesses that employ computer operators or provide technical support to computer users may be prudent to consider the comfort and mood of computer operators while they work. Though this study only indicated that network errors were increased by the computer operators with higher anxiety, there might be other effects on electronics that increase as anxiety rises.

Many people have experienced computer errors when they are anxious or frustrated, and they often attribute these errors to a lack of attention or stupid mistakes. Though many errors may be the result of simple mistakes, additional errors may be the result of an unconscious effect that appears or is amplified when computer users are anxious. Regardless of the cause, the same series of actions may resolve the situation. Walk away from the computer and go down the hall to get a drink. Take a break, calm your mind, and take a deep breath before going back to your computer. The problems just might go away when the anxiety is reduced.

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Appendix

User Interactive Software Tasks and Obstructions

Sixteen (16) tasks were presented to every participant in this study. The tasks were common tasks that are familiar to most computer users including simple games, addition, and typing in text boxes. The participants were instructed to complete all of the tasks in 20 minutes to receive a reward. There were obstructions for some of the participants to induce a sense of urgency and possibly anxiety. The tasks and obstructions are described below.

General Obstruction:

When participants are using the "obstructed" version of the software, between each task screen, a dialog box appears indicating how much time has gone by and how much time is left. The user must click away the dialog box before they can go onto the next screen.

Task 1. Move a ball from one side of the screen to the other using the mouse. Click on the ball and drag it to the hole.
Obstruction: none
Task 2. Type a single word that is on the left side of the screen in a text box on the right side of the screen.
Obstruction: The text disappears when the user moves their mouse over the "Continue" button. It must be retyped. To complete the task.
Task 3. Choose the photos that contain water.
Obstruction: One of the photos that contain water must be clicked three times before the click registers.
Task 4. Add two six-digit numbers.
Obstruction: When typing the result in a text box, the 7 character is initially entered as the 6 character. It must be corrected.
Task 5. Choose the box that contains the darkest shade of grey.
Obstruction: Clicking on the correct box selects another box on the screen. This occurs two times before the correct box will register the click.
Task 6. Type a sentence from the left side of the screen in a text box on the right side.
Obstruction: Some characters are changed during typing and the sentence must be retyped until it is correct.
Task 7. Click the boxes to reveal a face. Find two matching faces to clear the boxes from the screen. When all the boxes are gone, move on to the next page.
Obstruction: Boxes reveal the face for less than one second. When matches are found, the boxes stay on the screen and make the user wait for 3.5 seconds before allowing them to click to find another pair.
Task 8. Twenty-four cards on displayed face down. Find the Jack of Hearts by click to reveal each card.
Obstruction: The user must click every card before the Jack of Hearts is displayed. It's always the last card.
Task 9. Type a paragraph in a box at the top of the screen into a text box at the bottom. This task was difficult, so a button labeled "Give Up" was added to be displayed after 5 minutes had passed.
Obstruction: Some letters are purposefully mistypes and must be corrected before the "Continue" button can be pressed.
Task 10. Select the image of a key to open an image of a door. Five keys are presented and three doors are presented. The user had to find the correct keys for the doors.
Obstruction: none.
Task 11. An image of a face is flashed on the screen for less than one second. Select the hair color, eye color, and gender of the person in the photo. A button is provided to show the photo again. The same photo is shown each time.

Obstruction: The photo changes each time the button is pressed until five different photos have been shown. Also, the photos appear on the screen for a very short period of time, and can barely be seen.
Task 12. There are twenty-four cards shown on the screen, but only the back of the card is displayed. Find the five cards that have "wavy lines" on them (like the ESP test cards). Clicking a wrong card adds three seconds to your time.
Obstruction: The final card with wavy lines is always the last card that is turned over.
Task 13. Create change to make 92 cents using coins. A set number of each coin is available to make this total.
Obstruction: When the first try is completed, it is always wrong, and the amount changes from 92 cents to 91 cents without any obvious indication of the change.
Task 14. Click on a running digital clock to stop it at exactly 10.0 seconds. You can reset the clock if you get it wrong. After five tries, it automatically says "Close enough" and lets the user continue.
Obstruction: The first five tries, it always misses by at least 0.1 seconds, and the user must try again. After fifteen tries it automatically allows the user to continue.
Task 15. Find a hidden object behind trees and tents in the forest. Click on an image to reveal what's behind. Clicking the wrong object adds five seconds to the time.
Obstruction: When you click the wrong item, it pauses the screen for three seconds before another item can be selected.
Task 16. Same as Task 1. Move the ball to the hole.
Obstruction: none

Une Exploration des Effets de l'humeur et de l'émotion sur un Système Informatique et un Environnement de Réseau Fonctionnant sur le Monde Réel

Résumé. Cette étude emploie un système et un réseau informatiques spécifiques conçus pour induire de l'anxiété chez des participants et déterminer si les personnes anxieuses produisent plus d'erreurs dans un réseau informatique fonctionnant indépendamment. Les participants (N = 130) ont complété seize tâches sur un ordinateur en vingt minutes afin de recevoir une récompense. Chaque participant évaluait ses niveaux d'anxiété durant les tâches. En parallèle, 130 sessions étaient lancées sans aucun opérateur informatique. Le réseau fonctionnait indépendamment des tâches, et opérait continuellement durant les sessions. La première hypothèse prédisait que les sessions sans opérateurs produiraient moins d'erreurs de réseau que les sessions avec opérateurs, mais cela ne fut pas vérifié (p = 0.35). La seconde hypothèse prédisait que les opérateurs anxieux produiraient plus d'erreurs sur le réseau indépendant que ceux avec moins d'anxiété. L'analyse initiale indiquait une hypothèse non-vérifiée, mais le design initial n'identifiait pas correctement les utilisateurs anxieux. Un regroupement révisé post-hoc basé sur la véritable anxiété rapportée a permis de vérifier cette hypothèse (p = 0.04, d = 0.45), indiquant que les opérateurs informatiques anxieux pouvaient affecter le réseau de communication. Il y a pu avoir d'autres effets électroniques produits par les émotions humaines. D'autres recherches sont nécessaires pour confirmer ces résultats et explorer si l'intensité des émotions affecte l'électronique.

Eine Untersuchung über die Auswirkungen von Stimmung und Emotion auf als Reale-Welt funktionierendes Computersystem und Netzwerkumgebung

Zusammenfassung. Diese Studie verwendete ein kundenspezifisches Computersystem und Netzwerk, das entwickelt wurde, um bei Teilnehmern Angst zu induzieren und um festzustellen, ob ängstliche Menschen mehr Fehler in einem unabhängigen Computernetzwerk produzieren. Die Teilnehmer (N = 130) wurden gebeten, in zwanzig Minuten sechzehn Aufgaben an einem Computer zu erledigen, um eine Belohnung zu erhalten. Jeder Teilnehmer bewertete selbst sein Angstniveau während der Aufgaben. Darüber hinaus wurden 130 Sitzungen ohne einen Computeroperator durchgeführt. Das Netzwerk lief unabhängig von den Aufgaben und war während der Sitzungen kontinuierlich in Betrieb. Die erste Hypothese prognostizierte, dass Sitzungen ohne Operatoren weniger Netzwerkfehler produzieren würden als Sitzungen mit Operatoren, was sich nicht bestätigte (p = 0,35). Die zweite Hypothese prognostizierte, dass Ängstliche mehr Fehler im unabhängigen Netzwerk produzieren würden als weniger Ängstliche. Eine erste Analyse bestätigte die Hypothese nicht, aber das anfängliche Design identifizierte ängstliche Benutzer nicht richtig. Eine post-hoc vorgenommene Gruppeneinteilung, die auf der Grundlage der tatsächlich berichteten Angst basierte, führte zu einer Bestätigung dieser Hypothese (p = 0,04, d = 0,45), was darauf hindeutet, dass ängstliche Computeroperatoren die Netzwerkkommunikation beeinflussen können. Es können andere elektronische Effekte als Folge menschlicher Emotionen auftreten. Weitere Forschungen sind notwendig, um diese Ergebnisse zu bestätigen und zu untersuchen, ob die Intensität von Emotionen elektronische Geräte beeinflussen kann.

Una Exploración de los Efectos del Estado de Ánimo y Emoción en un Entorno Realists de Sistema y Red Informáticos

Resumen. Este estudio utilizó un sistema informático y una red diseñados para inducir ansiedad en los participantes y determinar si las personas ansiosas producen más errores en una red informática que funciona independientemente. Se pidió a los participantes (N = 130) que completaran 16 tareas en una computadora en veinte minutos para recibir una recompensa. Cada participante calificó sus niveles de ansiedad durante las tareas. Además se corrieron 130 sesiones sin un operador en la computadora. La red funcionaba independientemente de las tareas y operaba continuamente durante las sesiones. La primera hipótesis pronosticaba que las sesiones sin operadores producirían menos errores de red que las sesiones con operadores, pero no fue así (p = 0.35). La segunda hipótesis predijo que los operadores ansiosos producirían más errores en la red independiente que aquellos menos ansiosos. El análisis inicial no respaldó la hipótesis, pero el diseño inicial no identificó adecuadamente a los usuarios ansiosos. Un agrupamiento post hoc basado en la ansiedad real reportada apoyó esta hipótesis (p = 0.04, d = 0.45) indicando que los operadores de computadora ansiosos pueden afectar al sistema de la red. Pueden haber otros efectos electrónicos afectados por las emociones humanas. Se necesita más investigación para confirmar estos resultados y explorar si la intensidad de las emociones afectan a la electrónica.