

Social and Psychological Influences on Computer User Frustration
(Newhagen book chapter)

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Abstract

As computer usage has proliferated, so has user frustration. Even devoted and knowledgeable users encounter annoying delays, incomprehensible messages, incompatible files, and indecipherable menus. The frustration generated by these problems can be personally disturbing and socially disruptive. Psychological and social perspectives on frustration may clarify the relationships among variables such as personality types, cultural factors, goal attainment, workplace anger, and computer anxiety. These perspectives may also help designers, managers, and users understand the range of responses to frustration, which could lead to effective interventions such as redesign of software, improved training, better online help, user discipline, and even resetting of national research priorities.

Introduction

Every computer user encounters problems with technology. Frustration is a common theme among computer users. Frustration tends to be the result when, for example, a computer application crashes with no warning, taking the last thirty minutes of work with it. As technology rapidly advances, users must deal with the ensuing error messages that invariably result, as well as the gap in knowledge that users face when a new technology or software emerges. We believe that user frustration is a significant issue that has consequences and implications in many areas. For instance, many policymakers discuss the digital divide, which is the growing gap between those who have access to computers and networks, and those who do not. But even if universal access to technology is attained, users will still struggle with the technology. Even with up-to-date hardware and software, sufficient training and documentation, and tech support, users may find computers difficult to use (Kraut, Scherlis, Mukhopadhyay, Manning, and Kiesler, 1996). This is unfortunate, since the use of well-designed, easy to use software, along with sufficient support and training, can make a measurable impact on the lives of people. A good example of using technological resources to improve the economic situations and overall lives of people is the community networking and software project developed at MIT for the residents of Camfield Estates, a low-income housing community in Roxbury, MA (Pinkett, 2002). Certainly, computers should be designed in ways that make the user experience more pleasant for everyone, including users of various ages, cultural backgrounds, and economic situations, which is known as universal usability (Shneiderman, 2000). But while universal usability is the end goal for technology, it is important to first examine the root causes of user frustration, from a social psychology point-of-view. It is possible that there are other techniques, aside from improved computer design, that could impact or lessen user frustration.

This chapter examines the factors that influence the experience of frustration in computer usage. This chapter has three goals: 1) to examine the research literature on human frustration, 2) to place the frustration research in the context of human-computer interaction, and 3) to present a new model of user frustration with technology.

Individuals' prior experiences, psychological characteristics, level of computer experience, and social system can all affect how they deal with frustrations with their computers. In addition, factors such as the importance of the task that was interrupted, the frequency of occurrence (both of same and different frustrations), and the amount of time or work lost as a result of the problem, can affect the experience of frustration. The existing psychological literature on frustration provides a foundation for the examination of the frustration process in computer use. In addition, literature on computer attitudes and anxiety has relevance to the topic of frustration. Examining the factors correlated with frustration helps to elucidate the nature of the frustration experience as regards computer use. Based on this published research, a technology frustration model will be presented. Based on the technology frustration model, the implications for numerous stakeholders, including users, managers, software designers, and policymakers, will be discussed.

Frustration

A review of the psychological literature reveals diverse definitions of frustration. Sigmund Freud introduced frustration as a concept with external and internal aspects and related it to goal attainment. Frustration occurs when there is an inhibiting condition that interferes with or stops the realization of a goal. All action has a purpose or goal whether explicit or implicit, and any interruption to the completion of an action or task can cause frustration. For Freud, frustration included both external barriers to goal attainment and internal obstacles blocking satisfaction (Freud 1921). This concept of frustration as a duality is continued in the analysis of frustration as both cause and effect (Britt and Janus 1940). As a cause, frustration is an external event, acting as a stimulus to an individual and eliciting an emotional reaction. The emotional response, in this case, is the effect, the individual is aroused by this external cause and a response is often directed towards the environment.

Dollard et al. define frustration as “an interference with the occurrence of an instigated goal-response at its proper time in the behavior sequence” (Dollard, Doob et al. 1939). Because an instigated goal response entails only that the goal be anticipated, frustration is due to the expectation and anticipation of a goal, not the actual attainment of the goal (Berkowitz 1978). If the goal is unfulfilled, frustration is experienced because satisfaction was not achieved and the hopes of attaining the goal were suddenly destroyed. The thwarting or hindrance, terms often used synonymously with frustration, is not limited to the actual activity in progress, but relates to what the individual is expecting (Mowrer 1938).

Frustrations, in all of these cases, are aversive events (Ferster 1957) and have as their main defining feature the element of a barrier or obstruction. This barrier can take the form of an actual barrier, or an imaginary one such as the response to anticipated punishment or injury (Mowrer 1938). A frustrating situation, then, is defined as any “in which an obstacle – physical, social, conceptual or environmental – prevents the satisfaction of a desire” (Barker 1938). These blocks to goal attainment may be both internal and external (Shorkey and Crocker 1981), similar to the duality proposed by Freud. Internal blocks consist of deficiencies within the individual such as a lack of knowledge, skill, or physical ability. External blocks could include the physical environment, social or legal barriers such as laws or mores, or the behavior of other people.

Factors Affecting Level of Frustration

The level of frustration experienced by an individual clearly can differ, depending on the circumstances surrounding the frustrating experience, and on the individual. One major factor in goal formation and achievement is goal commitment, which refers to the determination to try for and persist in the achievement of a goal (Campion and Lord 1982). Research on goal theory indicates that goal commitment has a strong relationship to performance and is related to two factors: the importance of the task or outcome and the belief that the goal can be accomplished (Locke and Latham 2002). Individuals will have a high commitment to a goal when the goal is important to them and they believe that the goal can be attained (Locke 1996). How important the goal is to the individuals, in addition to the strength of the desire to obtain the goal (Dollard, Doob et al. 1939), will affect the level of goal-commitment as well as the strength of the subsequent reaction to the interruption. Self-efficacy, the belief in one’s personal capabilities, can also affect goal commitment (Locke and Latham 1990) in that the belief about how well a task can be performed when it involves setbacks, obstacles, or failures may affect how committed individuals are to that goal (Bandura 1986). Judgments of efficacy are related to the amount of effort expended, how long they persist at the task, and resiliency in the case of failure or setback (Bandura 1986; Bandura 1997). Self-efficacy also affects emotional states as well; how much stress or depression people experience when in difficult situations is dependent on how well they think they can cope with the situation (Bandura 1997). The level of frustration that people experience, therefore, would be affected by how important the goal was to them, as well as how confident they are in their abilities. “Because goal-directed behavior involves valued, purposeful action, failure to attain goals may therefore result in highly charged emotional outcomes,” (Linsecum 2000) including, we believe, frustration.

Cultural factors may also play a role in the level of frustration experienced by individuals when coming across obstacles to their path of action. Social Learning Theory (Bandura 1973) states that “rather than frustration generating an aggressive drive, aversive treatment produces a general state of emotional arousal that can facilitate a variety of behaviors, depending on the types of responses the person has learned for coping with stress and their relative effectiveness” (p. 53). The community and culture in which they are raised constrains the behavior of individuals, and their reactions and acceptable responses to frustrating situations are constrained as well. Hochschild (Hochschild 1979) and Ekman (Ekman 1982) have put forth two concepts associated with the way that emotions are governed by society, feeling rules and display rules. Feeling rules (emotion norms) regulate what kinds of feelings are appropriate and how intense or broad they are, as well as long they can last. Display rules (expression norms) regulate how these internal feelings can be displayed externally in terms of emotional behaviors. According to symbolic interactionist theory, emotions are caused by the arousal of individuals due to

environmental events combined with specific sociocultural factors (Schachter and Singer 1962). Mowrer (1938) suggests that human frustration is linked to two major aspects of culture: the transmission of useful techniques and skills across generations, and the perpetuation and enforcement of the regulations and codes that govern social conduct. Ways of coping with frustration are therefore learned from the society and are governed and constrained by the laws of a society. This can contribute to the level of frustration tolerance that individuals have, which is also affected by their prior experience and self-efficacy related to specific tasks.

According to Freud, it is not simply the nature of the frustrating incident that determines how people will react to the incident. Rather, there is an interplay between the situation and the psychological characteristics of individuals. The level of maturity of the individual also plays a part (Barker, Dembo et al. 1965) in the reactions to frustration. With maturity, there is an increase in the variety of responses to a situation employed by individuals, in the control of the environment, and in their ability to employ problem solving behavior and plan steps to obtain the goal. It would appear that learning, which is culturally determined, is a major factor in developing socially acceptable responses to frustration.

One final factor that may affect the force of the frustration is the severity of the interruption and the degree of interference with the goal attainment (Dollard 1939). All obstructions are not equally frustrating, the severity and unexpectedness of the block will also factor into the strength of the response. In addition, if individuals perceive that the thwarting was justified by socially acceptable rules, as opposed to being arbitrary, the frustration response may be minimized (Baron 1977). This may be due to the lowering of expectations because of extra information available to the individual. As stated above, it is the anticipation of success that affects frustration, and not the actual achievement of the goal. Therefore, if individuals expect to be thwarted or have a low expectation of success, frustration may be minimized.

Responses to Frustration

The responses to frustration by individuals can be either adaptive or maladaptive (Shorkey and Crocker 1981). Adaptive responses are constructive and are implemented to solve the problem that is blocking goal attainment. They may include preemptive efforts to avoid the block, or once the block is encountered problem solving strategies to overcome or circumvent the problem. Freud lists two types of adaptive responses: transforming stress into active energy and reapplying this energy towards the original goal, and identifying and pursuing alternative goals. Maladaptive responses, on the other hand, are characterized by a lack of constructive problem solving and often make the frustrating experience worse by creating additional problems. These maladaptive responses may be further categorized into objective (aggression, regression, withdrawal, fixation, resignation) and subjective (extrapunitive, intro-punitive, impunitive) responses (Britt and Janus 1940).

Aggression: Early research on aggression suggested that aggression is the natural, unlearned reaction to frustration (Mowrer 1938; Dollard, Doob et al. 1939). Other reactions to frustration occur as a result of the conditioning process achieved through cultural and societal restrictions. The Frustration-Aggression Hypothesis (Dollard 1939) stated that aggression is always a consequence of frustration with two propositions: aggressive behavior always presupposes the existence of frustration, and every frustration leads to aggression. However, subsequent research has shown that aggression is not the only resultant reaction to frustration, a fact attributed to prior learning experiences (Miller 1941; Bandura 1973). Through experience, individuals learn other, possibly more culturally acceptable, ways to react to frustration, which in turn inhibit the aggressive tendency. Subsequently, the Frustration-Aggression Hypothesis was revamped with a hierarchy of responses influenced by prior learning.

Regression: Barker et al. (1965) hypothesize that regression, defined by them as immature behavior, is the major response to frustration. Aggression, according to this theory, is simply one type of regressive behavior. As individuals mature, they develop a greater variety of responses as they are able to control their environment more and learn problem solving skills. Learning is the key factor to developing these socially acceptable responses.

Withdrawal: Also known as regression, withdrawal here refers to a flight reaction in the face of adversity. Withdrawal is a learned reaction as well, social conditioning, previous experience, or the anticipation of pain or punishment causes the individual to withdraw from the situation and thus reduce the state of tension caused by the frustration (White 1929).

Fixation: The repetition of courses of action that were once effective can occur either when this course of action was once successful in the past or because of a lack of skill or knowledge resulting in a low problem solving ability. Here, the ability to develop new ways of responding to situations is impaired. When severe frustration is encountered, Maier (Maier 1961) hypothesizes that fixation occurs completely and people become 'frozen' in a course of action and lose awareness of the external world.

Resignation: Also known as inertia or apathy, this occurs when individuals lose all motivation to pursue goal-directed activity and is characterized by a complete loss of hope.

Extrapunitive/Intropunitive/Impunitive: These three subjective responses were defined by Rosenzweig (Rosenzweig 1935) as responses to frustration. The extrapunitive response occurs when individuals get angry at something external such as people, objects, or circumstances, and blame the problem on an external source. Intropunitive responses occur when individuals attribute blame to themselves, and feel guilt or remorse about the situation. Impunitive reactions occur when individuals try to avoid blame or gloss over the situation and try to reconcile the situation or make excuses for the problem.

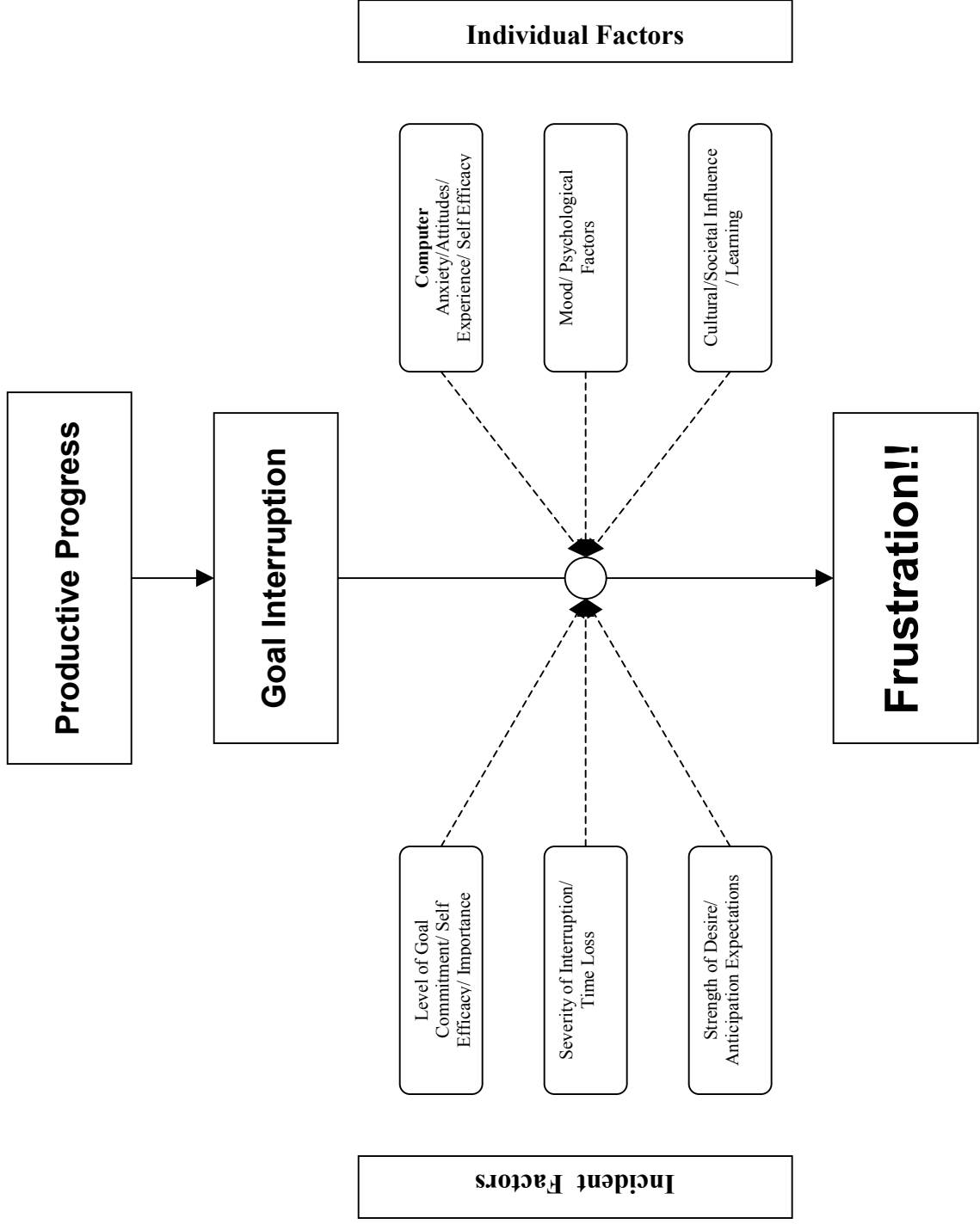
Computer Anxiety

The reactions of people to computers have also been studied extensively, particularly attitudes towards the computer (Loyd & Gressard 1984, Murphy, et al 1989, Nash & Moroz 1997) computer anxiety (Raub 1981, Glass & Knight 1988, Cohen & Waugh 1989, Cambre & Cook 1985, Torkzada & Angulo 1992, Maurer 1994), and computer self-efficacy (Meier 1985, McInerney et al 1994, Compeau & Higgins 1995, Brosnan 1998). Each of these variables, combined with the factors listed above, can affect how frustrated individuals will become when they encounter a problem while using a computer. The number of times a problem has occurred before can affect their perception of the locus of control, and therefore influence their reaction as well. This may be related to anxiety, people with low computer self-efficacy may be more anxious (Meier 1985; Brosnan 1998) and more likely to view the computer suspiciously and react with great frustration when something occurs, especially when they have run into it before. Different levels of anxiety will affect performance when something unforeseen or unknown occurs, causing anxious people to become more anxious (Brosnan 1998). On the other hand, the level of experience may temper this if the prior experience increases computer self-efficacy (Gilroy and Desai 1986) by lowering anxiety and reducing frustration when a problem occurs. The perceived ability to fix problems on the computer, as well as the desire to do so may also affect levels of frustration. If problems are seen as challenges rather than problems, they may not be as frustrating, which is most likely directly related to level of prior experience as well as computer self-efficacy.

Computing Frustration Model

There are many situations that can cause frustration in users. For instance, a software application may crash, an error message may be unclear, or an interface can be confusing (Preece, Rogers, and Sharp, 2002). If the computer interface does not provide sufficient information for the user, the user can be confused as to the current status of the system and the appropriate next steps (Preece, Rogers, and Sharp, 2002). When any of these things happen, users can lose work and waste time. A recent news report discussed users getting so frustrated with computers, that the users hit and break their computers, and in some cases, even assault their co-workers (BBC, 2002). The question is, what specific aspects of the situation or the individual lead to feelings of frustration? Based on the frustration literature, goal-attainment theory, and the literature on computer attitudes and anxiety, we propose a Computing Frustration Model (Figure 1).

Figure 1: Computer Frustration Model



Frustration theory indicates that it is the interruption of a goal or task that causes individuals to become frustrated. There are various factors that can then subsequently affect the level of frustration experienced. These fall into two categories: the incident-specific factors, and individual level factors.

Incident Specific Factors

The incident specific factors that affect the level of frustration experienced by end users include the level of goal commitment, the severity of the interruption, and the strength of the desire to obtain the goal. These are factors that are caused by the specific details of the incident, and these differ from incident to incident. For instance, if the user did not feel that it was especially important to complete the task, the result might be a low level of frustration. At the same time, if the task was very important, and there was a large amount of time lost while trying to achieve the goal, the user might experience a large level of frustration.

Goal theory tells us that experience, self-efficacy, and the importance of the goal all affect the commitment to the goal or task. When the goal interruption occurs, the level of goal commitment will affect the amount of frustration experienced by individuals directly. Severity of interruption can be thought of as a combination of the amount of time it took to fix the problem and the amount of time lost due to the problem. The strength of desire for the goal is also affiliated with how important the goal was, so importance is also used here as a proxy for strength of desire. These incident-specific factors, which influence the level of frustration, are harder to control, as they are unpredictable, as many of the causes of the user frustration are also unpredictable. The individual-level factors, discussed below, are more predictable, and are therefore easier to address.

Individual Level Factors

Individual level factors affecting the strength of the frustration include computer experience variables, mood and other psychological factors, and the cultural and societal influences upon the individual. These individual-level factors influence the level of frustration, regardless of the specifics of the frustrating incident. For instance, satisfaction with life, how often users get upset over things, and general mood, can all affect the level of frustration, regardless of the specific cause of the frustration. Computer anxiety (i.e. how users feel about computer technology), as well as self-efficacy (i.e. how confident users feel in their ability to succeed), can also influence the level of frustration. Computer variables are separated into computer experience/self-efficacy and computer anxiety/attitudes. Finally, computer experience (factors such as years of computer use, and hours of computer use per week) can influence the level of frustration. A newer user may become more frustrated than an experienced user. These individual-level factors of user frustration are easier to address than the incident-specific factors of user frustration. For instance, to improve self-efficacy and lower computer anxiety, users may be offered training, and other forms of support, such as documentation or a help desk. New training techniques might be developed specifically to address user frustration, to prepare users, in advance, for situations that might be frustrating.

Conclusion

Based on the published literature and our technology frustration model, we can begin to understand the basis of user frustration, with the ultimate goal being to reduce the amount of frustration that users face with computers. Frustrating incidents are very problematic for users, who can waste large amounts of time trying to rectify these frustrating incidents. Preliminary research work on user frustration has found that nearly 30-45% of the time spent on the computer is wasted, due to frustrating situations (Ceaparu, Lazar, Bessiere, Robinson, and Shneiderman, 2002). Some of the most frustrating incidents reported by users included error messages, dropped/refused network connections, application freezes, and long download times (Ceaparu, Lazar, Bessiere, Robinson, and Shneiderman, 2002). The technology frustration model can highlight some of the actions that the various stakeholders (such as users, developers, and managers) can take towards the goal of lessening user frustration.

For Users:

While it is hard for users to predict in advance the various incident-specific factors (such as level of goal commitment, and time loss) that cause frustration, it seems that the individual-level factors that lead to frustration are easier to predict and account for. For instance, if self-efficacy is one of the major individual-level influences on frustration, then it is possible that comprehensive support for users can lessen the effects of frustration. For instance, support can come in the form of documentation (manuals), training, or a call center. It is possible that this support will improve the user's confidence, and perception that they can successfully respond to the frustrating situation.

While the employer should ideally be responsible for providing such support, if the employer fails to do so, it might be helpful for the user to acquire training or documentation, which will possibly increase self-efficacy of the user, thereby lowering their levels of frustration when dealing with troubling computer incidents.

For Developers:

Software developers can do much to assist with lessening the effects of frustration. Much of what causes user frustration with computers is due to poor or confusing design of the interface. For example, if one of the incident-level factors that influence frustration is the severity of interruption and the time loss, then good interface design, through error messages, can lower the time loss, and lower the resulting frustration. When encountering an error situation, a clearly-worded error message would allow the user to 1) have an understanding of what occurred, and 2) have an understanding of how to respond appropriately to the error situation (Shneiderman, 1998). If users have a clear understanding of what occurred, and how to respond, then the users may be able to exit the error sequence quickly and therefore return to their previous task goals, with only a minimal amount of time lost. If users cannot exit an error sequence quickly, then this can lead to other more serious errors, increasing the severity of the interruption (Carroll and Carrithers, 1984), and therefore, increasing the frustration. A good error message can speed along this process, helping users limit the amount of time lost, and limiting the severity of the interruption, possibly reducing levels of frustration. Other sources of user frustration, such as incompatible file formats and indecipherable menus, can also be alleviated by developers.

For Managers:

Managers in workplaces want their employees to succeed with their computer tasks. Ideally, the employee's computer tasks will help support the mission of the organization, and will therefore be important to the managers. To lessen the frustration, it might be helpful for managers to provide support to the users, to assist them in responding to the frustrating incidents. This user support may come in the form of a help line, tech support, training, and/or documentation. This support may assist with the individual-level components of frustration (from the technology frustration model), by making the users more confident in their ability to solve a frustrating situation, and providing the information that users need, to solve frustrating situations.

For managers, the individual-level components of frustration are easier to address than the incident-level components of frustration (from the technology frustration model). For instance, on the incident-level, the managers have no control over the time loss due to frustrating technology. In addition, another component of incident-level frustration is the importance of the task. To lower the level of user frustration, theoretically, the managers could lower the level of importance of the tasks. However, it is unlikely that the managers would lower the level of task importance, by telling the employees that the tasks are really not that important after all! Therefore, it appears that managers could positively affect the individual-level components of frustration, but it is unlikely that the managers could improve the incident-level components of frustration.

If users, managers, and developers work together, it is possible to lower the levels of user frustration. The user of the future should not be forced to deal with systems that leave them frustrated and unable to reach their task goals.

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References

- Bandura, A. (1973). Aggression: A Social Learning Analysis. Englewood Cliffs, NJ, Prentice-Hall.
- Bandura, A. (1986). Social Foundation of Thought and Action: A Social-Cognitive Theory. Englewood Cliffs, NJ, Prentice Hall.
- Bandura, A. (1997). "Self-Efficacy." Harvard Mental Health Letter **13**(9): 4-6.
- Bandura, A. (1997). Self-Efficacy: The Exercise of Control. New York, Freeman.
- Barker, R. (1938). "The Effect of Frustration upon the Cognitive Ability." Character and Personality **7**: 145-150.
- Barker, R., T. Dembo, et al. (1965). Frustration and Regression: An Experiment with Young Children. Frustration: The Development of a Scientific Concept. R. Lawson. New York, MacMillan Publishing Co.
- Baron, R. A. (1977). Human Aggression. New York, NY, Plenum.
- Berkowitz, L. (1978). "Whatever happened to the frustration aggression hypothesis?" American Behavioral Scientist **21**(5): 691-708.
- British Broadcasting Company (2002). Web rage hits the internet, February 20, 2002, available at: http://news.bbc.co.uk/1/hi/english/sci/tech/newsid_1829000/1829944.stm
- Britt, S. H. and S. Q. Janus (1940). "Criteria of Frustration." The Psychological Review **47**(6): 451-469.
- Brosnan, M. J. (1998). "The Impact of computer anxiety and self-efficacy upon performance." Journal of Computer Assisted Learning **14**: 223-234.
- Campion, M. and R. Lord (1982). "A Control Systems Conceptualization of the Goal-Setting and Changing Process." Organizational Behavior and Human Performance **30**: 265-287.
- Ceaparu, I., J. Lazar, K. Bessiere, J. Robinson, and B. Shneiderman (2002). "Determining Causes and Severity of End-User Frustration." Forthcoming.
- Cooper, M. N. (2002). "Does the Digital Divide Still Exist? Bush Administration Shrugs, But Evidence Says 'Yes'."
- Dickard, N. (2002). "Federal Retrenchment on the Digital Divide: Potential National Impact."
- Dollard, J., L. W. Doob, et al. (1939). Frustration and Aggression. New Haven, Yale University Press.
- Ekman, P., Ed. (1982). Emotion in the Human Face. Cambridge, Cambridge University Press.
- Ferster, C. B. (1957). "The Function of Aggression and the Regulation of Aggressive Drive." The Psychological Review **71**: 257-272.
- Freud, S. (1921). Types of Onset and Neurosis. The Standard Edition of the Complete Psychological Works of Sigmund Freud. J. Strachey. London, Hogarth Press. **12**: 227-230.
- Gilroy, F. and H. Desai (1986). "Computer Anxiety: Sex, Race, and Age." International Journal of Man-Machine Studies **25**(1): 711-719.
- Hochschild, A. R. (1979). "Emotion Work, Feeling Rules, and Social Structure." American Journal of Sociology **85**: 551-575.

- Kling, R. (ed.) (1999). *Computerization and Controversy: Value Conflicts and Social Choices*. Brooks/Cole Publishing Company.
- Kraut, R., Scherlis, W., Mukhopadhyay, T., Manning, J., Kiesler, S. (1996). The homenet field trial of residential internet services. *Communications of the ACM*, 39(12), 55-63.
- Lazar, J. and Huang, Y. (2003, in press). "Improved Error Messages for Web Browsers: An Exploratory Experiment". In J. Ratner (ed.) *Human Factors and Web Development*, 2nd Edition, Mahwah, NJ: Lawrence Erlbaum Associates, 167-182.
- Lazar, J. and Norcio, A. (2001) "Service-Research: Community Partnerships for Research and Training" *Journal of Informatics Education and Research*, 2(3), 21-25
- Lazar, J., and Norcio, A. (2003, in press). "Training Novice Users in Developing Strategies for Responding to Errors When Browsing the Web." *International Journal of Human-Computer Interaction*.
- Lincecum, L. (2000). The Effects of Software Disruption on Goal Commitment, Task Self-Efficacy, Computer Self-Efficacy, and Test Performance in a Computer-Based Instructional Task. *Instructional Technology*, Texas Tech University: 160.
- Locke, E. A. (1996). "Motivation Through Conscious Goal Setting." *Applied Preventative Psychology* 5: 117-124.
- Locke, E. A. and G. P. Latham (1990). *A Theory of Goal Setting and Task Performance*. Englewood Cliffs, NJ, Prentice Hall.
- Locke, E. A. and G. P. Latham (2002). "Building a Practically Useful Theory of Goal Setting and Task Motivation: A 35-Year Odyssey." received from author.
- Maier, N. R. F. (1961). *Frustration: The Study of Behavior Without a Goal*. Ann Arbor, University of Michigan Press.
- Meier, S. (1985). "Computer Aversion." *Computers in Human Behavior* 1(1): 171-179.
- Miller, N. E. (1941). "The Frustration-Aggression Hypothesis." *The Psychological Review* 48: 337-342.
- Mowrer, O. H. (1938). "Preparatory Set (Expectancy) -- a Determinant in Motivation and Learning." *Psychological Review* 45: 62-91.
- Mowrer, O. H. (1938). "Some Research Implications of the Frustration Concept as Related to Social and Educational Problems." *Character and Personality* 7: 129-135.
- Murphy, C., D. Coover, et al. (1989). "Development and Validation of the Computer Self-Efficacy Scale." *Educational and Psychological Measurement* 49: 893-899.
- Nash, J.B. and P.A. Moroz (1997). "An Examination of the Factor Structures of the Computer Attitude Scale." *Journal of Educational Computing Research*. 17(4): 341-356.
- Pinkett, R. (2002). Camfield Estates-MIT Creating Community Connections Project: High Technology in a Low-to-Moderate Income Community. In J. Lazar (ed.). *Managing IT/Community Partnerships in the 21st Century*. Hershey, PA: Idea Group Publishing, 221-246.
- Preece, J., Rogers, Y., and Sharp, H. (2002). *Interaction Design: Beyond Human-Computer Interaction*. New York: John Wiley & Sons.
- Rosenzweig, S. (1935). "Tests of Frustration." *American Journal of Orthopsychiatry* 5: 395-403.

Schachter, S. and J. Singer (1962). "Cognitive, Social, and Physiological Determinants of Emotional State." Psychological Review **69**: 379-399.

Shneiderman, B. (1982). System message design: Guidelines and experimental results. In A. Badre and B. Shneiderman (eds). *Directions in Human/Computer Interaction*. Norwood, NJ: Ablex Publishing, 55-78.

Shneiderman, B. (2000). Universal Usability: Pushing Human-Computer Interaction Research to Empower Every Citizen. *Communications of the ACM*, *43*(5), 84-91.

Shorkey, C. T. and S. B. Crocker (1981). "Frustration theory: a source of unifying concepts for generalist practice." Social Work: 374-379.

United States Congress. (1996). *Telecommunications Act of 1996 (P.L. 104-104)*. Washington, D.C.: U.S. Government Printing Office.

United States Department of Commerce (1999). *Falling Through the Net: Defining the Digital Divide*. Available at: <<http://www.ntia.doc.gov/ntiahome/ftn99/contents.html>>

United States General Accounting Office. (1998). School technology: Five school districts' experiences in funding technology programs (GAO/HEHS-98-35). Washington, D.C.: United States General Accounting Office

White, W. A. (1929). "The Frustration Theory of Consciousness: Mind as Energy." Psychoanalytical Review **16**: 143-162.