© Journal of the Indian Academy of Applied Psychology,
January 2006, Vol. 32, No.1, 53-60.

Influence of Mood on Estimation of Time

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The study investigated the influence of mood patterns on estimation of time. A neutral and two brief stressful film stimuli were presented to 25 men and 25 women subjects in a repeated measures design. The variations in mood and prospective duration estimates were recorded. Findings revealed that the duration of stressful scenes was underestimated while that of the neutral scene was over estimated. The accuracy and directionality of verbal duration estimates are explained in light of the attentional gate and contextual change model with an underlying emphasis on mood.

Influence of Mood on Estimation of Time: What is the need to study time? Do moods play any role in duration estimates? Various kinds of time judgments are involved in everyday behavior. Such as in estimating the time it will take to reach office, or stopping the car at the red light or the amount of time that will be required to finish a task, etc. Though the importance of time often goes unnoticed, nonetheless it mediates a variety of cognitive experiences. Researchers often study how people make relative duration judgments or temporal discriminations (Boltz, 1995; Block, 1992), or estimate an event's actual duration from memory. The main concern of the time estimation research has been to determine the factors that result in the relative accuracy of these estimates. Also examine the systematic distortions wherein the actual duration is either over estimated or under estimated. Various attempts have been made to examine the effects of certain constitutional states within the person that might lead to temporal distortions such as stress and arousal (e.g., Delay & Mathey, 1985;Zelkind, 1973; Falk & Bindra, 1954).

Certain stimulus characteristics that influence cognitive processing of event durations have also been examined, such as, degree of familiarity and structural coherence (e.g., Boltz, 1992b), context effects (Block, 1992) or task demands (e.g., S.W. Brown, 1985). It is important to study time estimation behavior because they relate to more general issues within everyday behavior, having important implications in adapting to a variety of environmental stressors to ensure optimal functioning.

Very few researchers have acknowledged the potential influence of certain constitutional variables on experienced or remembered duration (e.g., Block, 1992; Ornstein, 1969). There is hardly any research evidence focusing on the effects of certain constitutional factors such as mood on the cognitive processing of event durations. Moreover, there has been no systematic investigation of these effects in a laboratory setting. The present research attempts to investigate how variations in mood patterns may affect prospective duration estimates of an events' actual duration in a laboratory.

Estimating an events' actual duration: Much research on duration estimation has relied on the use of prospective designs. Within a prospective design, the participants know in advance that a time judgment will be required. Hence, they reflect the experience of time in passing or perceived duration (Boltz, 1995). The participants are asked to estimate the length of the interval in minutes or

seconds. Hence the relationship between perceived duration and actual stimulus duration could be determined by obtaining multiple time estimations from one participant. This kind of research has important applications because it generalizes to situations in the natural environment. This is so because people often use clock time to schedule and coordinate different activities efficiently.

When an events' actual duration has to be estimated various factors influence its accuracy. Many natural events, which are characteristic to that particular event, transpire over a given period and remain invariant over different occasions. While recalling an events' actual duration from memory one may compare the duration of one event relative to another. Relatively little research has investigated the accuracy with which people are able to recall event durations and the different cognitive mechanisms which may be involved. Participants may be asked to judge the duration of an experimental session spent in proof reading a passage in the presence or absence of music. Results of various such studies show that as task difficulty increases, time judgments become more inaccurate and unreliable (Hicks et al., 1976).

These observations are explained in terms of the resource allocation theory (Kahneman, 1973) whereby increased task demands limit processing resources. Hence, time estimates suffer because less attention is devoted to durational information. When complex stimuli are presented to the participants, their resources are restricted, and less attention is focused on the time related information such as contextual changes etc., (Brown, 1985). The inherent structure of the event is also used to attend as well as remember the sequence of activities, which take place in the event. The degree of event coherence determines how well these activities are performed (Jones & Boltz, 1989). Natural events contain an array of both temporal and non-temporal information, which are interrelated in a hierarchical scheme. The learning and remembering of coherent events require less attentional effort because their temporal information is inextricably interrelated with the non temporal information, such that they can define one another. Hence, these events are relatively easy to track over time and yield a more accurate recapitulation of event structure (Boltz, 1992b). It is then evident that remembering an events time span involves retrieving both temporal and non-temporal information within this span. Films represent natural events, displaying an underlying hierarchical arrangement of story relationships. These stories consist of a theme, a setting, a plot, and a resolution.

The events structure in a film approximates a hierarchical scheme in which lower level information (actions) are nested within higher level grammatical phrases (episodes) related to an overarching theme (i.e., story's gist). Highlighting of these nested relationships facilitates learning and attending and provides people with an effective retrieval scheme with which to re perceive the event (Block, 1992). Moreover films also vary in their internal predictability as other natural events therefore their duration estimates can be more inaccurate. This suggests that temporal and non-temporal information within an event are not processed independently (Boltz, 1992b) across all tasks and event situations. Rather they depend upon the degree of overall predictability within the total time span.

Block and Reed (1978) reported evidence that suggests that important changes during time period do influence its remembered duration. These changes include variables such as background stimuli, interoceptive stimuli (e.g., posture, temperature), the psychological context that is, the internal monologue or what the participant is thinking about (Bower, 1981). The duration of an event is remembered longer depending upon the extent to which there are changes in the processed context (Block & Reed, 1978). According to their contextual change model, remembered duration involves cognitive reconstruction based on the contextual information that is stored as an integral part of the memory encoding of events, rather than as a reconstruction based on retrieving stimulus information per se. The greater are the encoded and retrievable contextual changes, the longer is the remembered duration of the time period.

Block (1992) suggests that the processing activities of a person (e.g., encoding strategies) interact with the kind of information – processing task in which the person is involved. These in turn influence the remembered duration of the task. By investigating time estimation within a naturalistic setting (i.e., films), one can determine whether perceiving and remembering processes are linked to a common attentional scheme and ways in which an event structure in general is used to guide remembering. This type of behavior is adaptive from

a cognitive – evolutionary perspective, such that a common set of strategies may be applied to a wide variety of events. There could be joint relationship between temporal and non-temporal structure within these events, which could influence cognitive performance too.

Factors influencing time estimation: Equal durations are estimated differently depending upon the amount of information presented or processed during the time period. Duration judgments tend to vary according to the stimulus complexity (Block, 1992), familiarity & task difficulty (Brown, 1985), temporal expectations and allocation of attention (Boltz, 1995), distraction (Zakay & Block, 1997), arousal level and the number of chunks within an interval (Ornstein, 1969), number of changes and attentional demands (Block, 1992) and complex interaction between the conditions under which a duration is experienced and the context in which the time is estimated (Block, 1992).Duration estimations usually lengthen if a time period contains a greater number of meaningful events. The meaningful events may be external as temperature, lighting in a room, or internal, such as changes in thoughts, information processing strategies or moods.

Models of prospective timing: Under prospective conditions, the participants focus their attention on time during target duration and accumulate relevant temporal cues. This plays an important role in duration experience (Block, 1992). Another model proposes that experienced duration of time depends upon the amount of information encoded by a temporal and non-temporal information processor (Thomas & Weaver, 1975). Task demands determine the way in which a person divides attention between two processors. If less non temporal (stimulus) information processing is required, the person allocates more attention to the temporal information and visa versa. The attentional gate model suggests that the individual may divide attentional resources between attending to external events and attending to time (Zakay & Block, 1997). Attending to time opens the attentional gate, thereby allowing pulses to pass through to the cognitive counter to the working memory store. When the task ends, the accumulated pulse total is sent to the reference memory store. Comparing the pulse totals from working memory with those previously stored in the reference memory makes duration estimates. The amount of attention allocated to temporal cues is inversely related to attentional demands of the task.

When a relatively easy nontemporal task fills duration, more attentional resources are available for opening the attentional gate. As a result more pulses are accumulated per unit time leading to overestimations. When the workload is high, less attention is focused on time and therefore more clock time is required to reach the target time.

Block (1992) proposed a contextual – change hypothesis of prospective duration judgment. The most important kind of information influencing duration judgments is varied contextual associations, which may serve as time- tags. Whenever a person allocates attention to time, contextual information concerning the previous act of attending to time is automatically retrieved, and a new time – tag (set of contextual associations) is encoded. Thus prospective duration judgments involve estimating the availability of the changes in these time- tags or temporal contextual changes.

Influence of moods on duration judgment: Moods refer to low intensity, diffuse, and relatively enduring affective states (Forgas, 1992), which have subtle influences on cognitive processes. People may simply infer a judgment from their prevailing affective state (Clore & Parrott, 1991). Affect may impair attention and cognitive processing capacity in positive or negative moods. For example, dysphoria leads to intrusion of negative thoughts into consciousness causing cognitive strain, reducing attentional resources as well as the motivation to process information.

It is difficult to differentiate between the terms affect and mood conceptually. For the present purposes, affect is utilized as a label referring to both moods and emotions. Moods influence the processing capacity, leading to selectivity in attention, learning and recall of information (Bower, 1981). It has been suggested that affective states exist for the sake of signaling the states of the world that have to be responded to. While negative affect particularly recruits a careful and substantive processing style. However, the processing consequences of mood are often indirect and context dependent (Martin et al., 1993). They are usually secondary to the processing requirements associated with the features of the target, the judge, and the situation (Forgas, 1992). Hence, complex targets are processed more substantively than heuristically even by happy participants.

Research studies also reveal that mood has a significant impact on the estimates of unfamiliar items and negative health events (Salovey & Birnbaum, 1989). The affective reaction one has towards an object often provides a basis for evaluating the object as well as making social judgments (Forgas, 1992). These temporary affective states may also predispose one to adapt different information processing strategies. How these affective states influence duration estimations is what this research proposes to investigate.

Affective states may either have an indirect or direct informational effect on judgments. Affect priming theory accounts for the indirect informational consequences of mood in terms of an associative network model of memory. It proposes that the greater availability of mood – related memories, constructs and associations influence interpretative processes as thinking and judgments (Isen, 1992). Affect priming model implies that mood effects should be strongest when judgments involve detailed constructive information processing .It is in the course of such elaborate processing that mood primed associations are most likely to be used in the selection and interpretation of stimulus material (Fiedler, 1991).

Bower (1981) suggests that an activation of the emotion node spreads activation throughout the memory structures to which it is connected. The selective priming of affect related information in turn focuses attention on the mood congruent details. These effects should lead to mood – congruent biases in memory and judgment.

The attribution model (Schwarz & Bless, 1991) suggests that mood itself may be a source of direct informational effects. Judges may use a heuristic strategy and mistakenly infer their reactions to a target from their prevailing mood. This model implies diminished processing tendencies for atypical targets. Thus people may take longer to encode information and form judgments about atypical targets, which may be unusual or complex.

Hence, affective states influence not only what one attends to, but also what is remembered. The purpose of this experiment was to examine the effects of moods induced by stressful film stimuli on time estimations. To what extent the accuracy of event durations are influenced by experienced moods? This problem is very important because it applies to everyday behavior. There are so many situations in a day, which make one temporarily stressed, and yet one must recognize the duration of the events around them. For example, the very first day in college may be stressful, meeting new students, attending association meetings, organizing students activities, making the timetable and orienting the students to the college environment, etc.

It is predicted that when one is attempting to remember the duration of a stressful event, this recapitulation process may involve mood and the associated cognitions. One may tend to think about the previous similar experiences, which may influence the accuracy of judgments to the extent one is affected by the affective content of the events depicted therein.

Method

Subjects

Fifty subjects (25 men and 25 women) pursuing postgraduate courses at the University of Delhi participated in this study. All the subjects had normal hearing abilities and normal or corrected eyesight. Their age ranged from 19 to 24 years (Mean age: 21.5 years).

Design

The design was a 2x3 factorial design with repeated measures on the second factor, with between subjects comparison of the subject variable i.e., gender (men and women) and a within subjects comparison of the stressful nature of the stimuli (neutral, aggressive and sad). The dependent variables of interest were mood and time estimation.

Materials

The two film scenes selected as stressful stimuli were 130 seconds duration each. A film scene from Hindi film “Rakhwala” depicted aggression in a violent fighting scene. A scene from Hindi film “ Paap ki aandhi” depicted sadness through a tragic scene. An excerpt from Delhi Doordarshan’s “Krishi daak” served as the neutral stimulus material. All the scenes were colored, well matched in layout, number of characters, and coherence. These scenes were most consistent in producing affective responses among 80% of the subjects in the pilot study. The stimulus duration of 130 seconds was selected because most of the subjects in the pilot study reported time estimates in halves or full (two minutes or two and a half minutes). Thus taking such a stimulus interval would help record even

a small tendency of the subject to over or under estimate the event duration. Also there would be a smaller probability of estimating of time by sheer guesswork.

Apparatus

The film scenes were presented on a Beltek Eurosit 51" TV via E-240 VCP.

Self report measures

Adjective checklist of mood (Nowlis, 1956) was used to obtain immediate affective response to stressful film scenes. The checklist consists of nine factors, which describe different adjectives for a persons' mood at any given time.

Procedure

The subjects were instructed that they would be watching film scenes. They were informed that immediately following the presentation of a given scene, they would be required to estimate how much time, to the nearest second, seemed to have transpired between the film scenes' beginning and its end.

After giving a "ready" signal the scene was presented to the subject. As soon as the scene was over, a "stop" signal was given and the subject was asked to estimate the duration of the scene verbally. Following this the adjective checklist of mood was given to the subject to report his or her mood after viewing the scene on a four point scale, ranging from most descriptive of mood (rating of 1) to definitely not descriptive of mood (rating of 4).

First the neutral scene was shown to each subject, and then the two stressful scenes were presented randomly. The order of presentation of the stressful scenes was randomized afresh for each subject. While neither viewing the scene it was made sure that the subject was not engaged in any muscular activity nor wearing a watch to avoid any distraction. After the experimental session was over, the subject was shown a brief comedy scene so that he or she left the laboratory in a pleasant state.

Results

Mood

The adjective checklist of mood (Nowlis, 1956) was used to assess the mood patterns of the subjects after viewing each film scene. A 2x3 (gender x stressful film stimuli)Analysis of variance(ANOVA)was performed on each factor of the checklist. The Analysis of Variance revealed a significant difference in the subject's mood after viewing the different kinds of scenes. After viewing the three kinds of scenes there were significant variations in the levels of Concentration [F (2, 147)=7.49, p<. 01], Aggression [F (2,147)= 6.15,p<. 01], Pleasantness [F (2, 147)= 15.60,p<. 01], Activation [F (2,147)= 12.05,p< .01], Depression [F (2,147)= 50.95,p<. 01] and Anxiety [F (2, 147)=4.22,p<. 05]. Duncan's test revealed that subjects felt significantly more concentrative, aggressive, depressed, and anxious after viewing the sad scene as compared to the aggressive and neutral scenes. However, after viewing the aggressive scene subjects felt significantly more anxious, aggressive, activated, pleasant as well as depressed as compared to the neutral scene. These differences in the mood patterns could be due to a stronger impact of the stressful film scenes as compared to the neutral scene.

Time estimation

The verbal estimation data were analyzed for both their overall accuracy (absolute error scores) and the percentage of error. Analysis of Variance was conducted on the percent error scores in time estimation. The results revealed that the effect of Factor A (gender) was non-significant indicating that men and women did not vary in their duration estimates. The mean time estimated by men was 123.59 seconds (m% error= 4.93%) and by women it was 138.04 seconds (m% error= 6.2%).

The main effect of Factor B (stressful nature of film stimuli) was found to be significant [F (2, 96)= 7.23, p<. 01]. Thus implying that there are significant differences between the duration estimates of the stimulus interval filled with the stressful nature of film material.

The Duncan's multiple range test was applied to the difference between mean for different types of scenes. It revealed a significant difference in the duration estimates for the sad scene (MSe=48.04,p< .01) and for aggressive scene (MSe=45.28,p<. 01) as compared to the neutral scene. However, between the two kinds of stressful scenes i.e., sad and aggressive scene there was no significant differences in the duration estimates. There was error in the duration estimates for all kinds of scenes; however, it was found to be maximum for the neutral scene. The neutral scene was over estimated (m% error=31.92, mean time estimated=162.42 seconds) as compared to the stressful scenes, which were underestimated. The under estimation was more for the aggressive scene

Table 1: Mean Ratings of Mood Patterns of the Subjects after viewing different kinds of scenes

Mood Patterns	Kind of Scene			F (df =2,47)
	Neutral (n=50)	Aggressive (n=50)	Sad (n=50)	
	M (SD)	M (SD)	M (SD)	
Concentration	2.86(1.04)	2.70(1.01)	2.12(0.96)	7.49**
Aggression	3.20(0.97)	3.07(1.06)	2.49(1.18)	6.15**
Pleasantness	3.04(1.07)	3.40(1.17)	3.54(0.78)	15.60**
Activation	2.82(1.94)	2.03(1.16)	3.12(1.07)	12.03**
Deactivation	2.91(1.01)	3.55(0.89)	3.31(1.06)	5.28**
Egotism	3.24(0.94)	3.27(1.04)	3.17(1.02)	0.13
Social Affection	3.10(1.09)	3.14(1.02)	2.75(1.16)	1.93
Depression	3.58(0.85)	3.16(1.06)	1.80(0.84)	50.95**
Anxiety	3.45(0.78)	3.48(0.91)	2.99(1.11)	4.22*

* $p < .05$ ** $p < .01$

(m% error= -16.12%, mean time estimated = 113.88 seconds) as compared to the sad scene (m% error= - 13.36%, mean time estimated = 116.64 seconds).

However, the AB interaction was found to be non significant. Thus indicating that there were no gender differences in the duration estimations for the stressful film stimuli.

Discussion

The results of this study provide evidence that the mood variations induced by the stressful nature of stimuli are a major determinant of the overall accuracy of duration judgment. The film scenes presented, as stimuli were coherent, well matched in layout, characters, story length, internal hierarchical organization of structure. They only varied with respect to the emotional content depicted therein, that is, stressful or neutral. The verbal estimations of durations for these stimuli varied because the subjects not only had to recapitulate the event's duration from memory, but to then translate this time span into clock units of minutes and seconds. The difference in the accuracy for the duration estimates of the scenes could be due to their mood variations caused by the stressful content of the scenes.

Considering the obtained results it seems that the qualities associated with the stressful content of the scenes was strong enough to influence the viewers' affective state as well as the judgments of event durations. There is empirical evidence demonstrating that the accuracy of duration estimates is influenced by various factors. Duration was underestimated for stress conditions (Gupta & Prasad, 1967), increased information load (Hicks et al., 1976), unpleasant affect (Khosla & Gupta, 2000), and induced stress (Melges, 1982).

It has been suggested that affective stimuli induce a higher level of physiological arousal, which leads to underestimation of judged duration. The greater the rate of the physiological activity (Ornstein, 1969), the faster the output of the internal pacemaker and swifter the flow of time.

People actively regulate mood being sensitive to the situational demands. Their affective reactions to the situation can hence provide a basis for evaluating the stimulus and making judgment (Clore & Parrott, 1991, Forgas, 1992). Affective states mediate an indirect effect on judgments. The obtained results can be explained on the basis of the affect priming theory whereby the mood state tends to form an associative link between the memory pathways influencing the judgments of time. Hence, greater the availability of mood –related memories, constructs and associations, greater is their influence in interpretative processes, thinking and judgment. It is possible that viewing of stressful scenes

activates similar emotional node thus spreading activation throughout the memory structure to which it is connected. This selective priming of affect related information in turn focuses attention on mood congruent details. Hence, producing mood congruent biases in memory and judgment (Bower, 1981).

Affect impairs attention and the cognitive processing capacity both in positive and negative moods. The variations in moods caused by the stressful content of the scenes may act as a source of intrusion and distraction, thus imposing cognitive strain leading to attention deficits. This may also limit their memory and processing capacity. This could explain the errors in the estimation of duration.

It is possible that while viewing the stressful scenes subjects may have been reminded of previous traumatic or unpleasant experiences. This may have motivated them to compare the intensity of the perceived duration with that of experienced duration. The variations in the perceived emotional intensity and affect could have lead to gross underestimations in duration estimates. Thus subjects could have given a relative duration judgment instead of judging the actual duration of the scene from memory.

Studies have demonstrated that the degree of structural predictability (Boltz, 1995), coherence (Boltz,1992b) within the event is a major determinant of the overall accuracy of remembered duration. The accuracy of estimations markedly declined when their expectancies were either absent or systematically violated (Boltz, 1992b) or if the task was difficult (Block, 1992). Films display an inherent organization of information wherein the stories display a sequence of character's activities nested into higher-level episodes that vary in their relative importance to some theme. Films as other natural events in the environment also vary in their internal predictability thus explaining the obtained findings.

Most models of time claim that the temporal duration of an event is processed independently of its non-temporal information. This however, is not true because in the present study all the three scenes were structurally coherent, unfamiliar and unpredictable, yet their duration estimates varied considerably. Hence implying that though the temporal duration of an event may be encoded in a prospective design via conscious time keeping strategies (e.g., Boltz, 1992; Block, 1992), remembered duration is also inferred from the amount of non-temporal information too. More resources are allocated to process the non-temporal information as emotional expressions, voices, music, actions, dialogues, tone, etc., and limited resources are available to attend the duration of the event (Thomas & Weaver, 1975). Thus producing more inaccurate duration estimates.

Hence, there seems to be an inherent relationship between the temporal and the non-temporal information of an event, whereby both of them seem to co define one another. The recapitulation of the event is therefore assumed to include both its temporal as well as non-temporal information together.

The findings of the present study can be further explained by the contextual change model (Block & Reed, 1978). The internal monologue (e.g., Bower, 1981) while viewing the scenes also tends to influence the duration judgments. It is also suggested that the interaction between the encoding strategies and the information-processing task (Block, 1992) also influence judgments.

The time of the neutral scene was overestimated as compared to the other two scenes. This indicates that experienced duration is longer than remembered duration (e.g., Brown, 1985) in a prospective paradigm when a person attends to the passage of time of a neutral event. This kind of attentional deployment lengthens the experience of duration. The attentional – gate model (Zakay & Block, 1997) explains why the prospective duration estimates are longer for relatively easy tasks (as the neutral scene here) and shorter for more emotionally demanding tasks (the stressful scenes).

Thus it is suggested that mood can influence duration judgments of natural events in a very significant way. Though the accuracy of judgments depends upon task coherence, difficulty, complexity, familiarity and predictability, yet mood also contributes significantly in its estimation. The study attempts to link the variations in the affective content of the event to the attending and remembering processes. The inherent relationship between temporal and non-temporal information provides important insights into understanding the duration judgments of actual events. Hence, there are a variety of factors in the environment as well as the individual, which play a significant role in the tem-

poral experience.

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