

The Freezing and Unfreezing of Lay-Inferences: Effects on Impressional Primacy, Ethnic Stereotyping, and Numerical Anchoring

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Three experiments were conducted to test the hypothesis that primacy effects, ethnic stereotyping, and numerical anchoring all represent "epistemic freezing" in which the lay-knower becomes less aware of plausible alternative hypotheses and/or inconsistent bits of evidence competing with a given judgment. It was hypothesized that epistemic freezing would increase with an increase in time pressure on the lay-knower to make a judgment and decrease with the lay-knower's fear that his/her judgment will be evaluated and possibly be in error. Accordingly, it was predicted that primacy effects, ethnic stereotyping, and anchoring phenomena would increase in magnitude with an increase in time pressure and decrease in magnitude with an increase in evaluation apprehension. Finally, the time-pressure variations were expected to have greater impact upon "freezing" when the evaluation apprehension is high as opposed to low. All hypotheses were supported in each of the presently executed studies.

An important issue in the domain of social cognition concerns people's readiness to modify their judgments in the light of new evidence. The present work examines this issue from a standpoint of a theory of lay epistemology developed recently by Kruglanski and his associates (cf. Kruglanski, 1980; Kruglanski & Jaffe, in press; Kruglanski & Ajzen, 1983). In previous papers on lay epistemology attempts were made to demonstrate how the lay-epistemic framework provides a basis for (1) integrating the various models of causal attribution (see in particular Kruglanski, 1980); (2) further synthesizing them with the cognitive-con-

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sistency theories (cf. Kruglanski & Klar, Note 1); and (3) reconceptualizing judgmental biases and errors in lay-epistemic terms (cf. Kruglanski & Ajzen, 1983). By contrast to these mainly theoretical attempts the present work explores some empirical implications of the lay-epistemic framework in particular concerning conditions under which judgments may be sensitive or insensitive to new evidence. But before specifically addressing those conditions let us outline the lay-epistemic theory in some detail.

THE THEORY OF LAY EPISTEMOLOGY

The theory of lay epistemology concerns the process whereby people arrive at all their knowledge. Knowledge is considered in terms of its two aspects, its *content* and the *confidence* with which it is held. This suggests the two functions that the epistemic process has to fulfill. The contents of knowledge must be produced somehow. Thus we need to have a phase of *hypothesis generation*. Then a given degree of confidence needs to be bestowed on the knowledge in question. Thus we need to have a phase of *hypothesis evaluation or validation*.

The generation of hypotheses has to do with one's stream of associations and with the way ideas form in a person's mind. The validation of hypotheses is conducted in accordance with the principle of logical consistency: The individual deduces from a hypothesis under test some of its implications and tests them against the appropriate evidence. Should the evidence be logically consistent with the implications the individual's confidence in the hypothesis would be strengthened. And if no alternative hypotheses equally consistent with the evidence were apparent the individual might accept the hypothesis as true and come to regard it as firm knowledge. But the acceptance of any hypothesis is potentially revokable. For an individual could always become aware of a plausible alternative hypothesis or of an item of evidence inconsistent with the original hypothesis. A logical inconsistency can only be resolved *via* denying or conferring falseness on one of the contradictory propositions. Such attempts at denial are likely to be directed at the less firmly believed of those propositions. For instance, when a "hypothesis" clashes with a "fact" we usually abandon the "hypothesis." According to the present interpretation this is because a "hypothesis" represent a less firmly believed in proposition than a "fact."

If in principle an individual could generate cognitions inconsistent with any given hypothesis, a protracted belief in a hypotheses represents the "freezing" of the cognition-generation process: An individual accepts a given hypothesis as true because (s)he fails to generate a plausible enough alternative hypothesis or to become aware of a plausible enough bit of evidence inconsistent with the original hypothesis. The theory of lay epistemology specifies two categories of conditions affecting the tendency

of the hypothesis-generation process to "freeze" at some point or, conversely, be "unfrozen." These categories are (1) the individual's *capacity* to produce various alternative hypotheses on a given topic, and (2) his/her motivation to do so. A person's capacity to engender hypotheses on a given topic may have to do with his/her store of past knowledge and with situational factors affecting the momentary saliency or availability of various ideas. The individual's motivation to generate alternative hypotheses is assumed to be affected by needs in three separate classes: (1) the need for structure; (2) the fear of invalidity, and (3) the need for specific conclusions (the need for conclusional contents).

The need for structure is the need to have some knowledge on a given topic, any knowledge as opposed to confusion and ambiguity. A need for structure once aroused is assumed to have an inhibiting or freezing influence on the hypothesis-generation process because the generation of alternative hypotheses endangers the existing hypothesis or structure. A need for structure may be heightened every time a person is under a pressure to form a clear opinion or reach a definite conclusion. A special case of this is when a person is under the pressure to act, for action often requires orienting knowledge for its execution. Indeed, research evidence indicates that time pressure and the need to quickly reach a decision intensify the tendency to seek cognitive closure and to refrain from critical probing of a given seemingly adequate solution to a problem (cf. Frenkel-Brunswick, 1949; Smock, 1955; Tolman, 1948).

The fear of invalidity stems from the perceived costs of committing a judgmental error. Opposite to the need of structure, the fear of invalidity is assumed to have a facilitating influence upon the hypothesis-generation process because of the expected dangers of committing oneself to a given, possibly mistaken hypothesis. For instance, the greater the ridicule expected from other people the stronger might be the individual's disposition to consider multiple alternative solutions to a given problem before accepting any one as valid. The foregoing analysis implies that where considerable costs hinge upon commission of an error, thus arousing the fear of invalidity, the individual will be more sensitive to evidence and ideas inconsistent with current beliefs and affording the generation of alternative or competing hypotheses.

The need for specific conclusions can sometimes facilitate and sometimes inhibit the generation of alternative hypotheses: When the hypothesis is desirable from the standpoint of some need or wish the individual will feel more disposed to accept it and to refrain from generating rival alternative hypotheses. To the contrary, when the hypothesis is undesirable the individual will be more inclined to replace it by a plausible alternative. The foregoing implies that a person whose current beliefs are desirable or need-congruent will be less sensitive to evidence or ideas inconsistent

with those beliefs than a person whose current beliefs are undesirable or need-incongruent. These ideas concerning conclusional biases are hardly novel. The thesis that people often engage in "wishful thinking" has long been a theme in psychological theorizing from psychoanalysis to the experimental study of perception (e.g., the "new look" approach of the 1950's).

Our epistemic analysis of "freezing" and "unfreezing" suggests that these processes pertain to judgments of all possible contents. Indeed, several heretofore disparate phenomena known to social-cognitive psychologists can be understood as instances of freezing manifest with different contents of judgment. In the present investigation we attempted to study from the epistemic perspective three such classical phenomena: Primacy effects in impression formation (cf. Luchins, 1957; Asch, 1946), ethnic stereotyping (cf. Hamilton, 1979), and anchoring phenomena (cf. Tversky & Kahneman, 1974). If all the above phenomena represent epistemic freezing they should be similarly affected by the hypothesized determinants of freezing such as the need of structure and the fear of invalidity mentioned earlier. One way to operationalize the need for structure would be *via* degrees of time pressure to reach a judgment. Thus we hypothesized that primacy effects, stereotypic judgments, and numerical anchoring would all be increased under a high-versus-low degree of time pressure. Furthermore, one way to operationalize the fear of invalidity would be *via* "evaluation apprehension" that is *via* anticipated costs to one's self-esteem of committing a judgmental error. Thus we hypothesized that primacy effects, stereotyping, or anchoring would all be *decreased* under high-versus-low degrees of evaluation apprehension. Finally, in situations where some judgment is ultimately required an interactive effect of time pressure and evaluation apprehension should be expected: The request to come up with a judgment introduces an inherent demand for structure. When the evaluation apprehension is low such a demand might represent the only situational goal; due to a ceiling effect this might render any further time-pressure manipulations of little additional impact. By contrast, when evaluation apprehension is high the situational demand for structure is countered by an opposed goal and its effects on the epistemic process may be below the "ceiling" level. Thus, when evaluation apprehension is high and there is ample time to make a considered judgment epistemic freezing may be avoided. However, when time pressure is introduced it may counteract the effects of evaluation apprehension and allow freezing to take place. In other words, experimental manipulations of time pressure may exert a greater effect on primacy effects, stereotypic judgments, and anchoring phenomena under high as compared with low degree of evaluation apprehension. The foregoing possibilities were examined in three experimental studies described below.

EXPERIMENT 1: PRIMACY EFFECTS

Primacy effects in judgmental behavior are generally said to exist when in judging an object or a person the individual bases his/her inferences predominantly on early information and appears to be affected less by late information (cf. Luchins, 1957). According to the present analysis, primacy effects can be interpreted as instances of epistemic freezing. On this view, an individual may attain closure early in the informational sequence and be relatively impervious to later information. For example, an individual might form a positive impression of another person if early information about this person was positive. Similarly, a person might form a negative impression of another if the early information was negative. All this, in relative disregard of later information which could often be inconsistent with the initial evidence.

In the present experiment we examined how primacy effects may be affected by the factors of time pressure and evaluation apprehension. Our epistemic analysis outlined earlier suggests that primacy effects should be *increased* under a high (versus low) degree of time pressure and should be *decreased* under a high (versus low) degree of evaluation apprehension. Finally, we predicted that the time-pressure variations would have greater impact upon primacy effects when the fear of invalidity is high rather than low.

Method

Subjects and Experimental Design

Eighty high school students in Ashkelon, Israel, participated as subjects. They were tested in groups of four to six members. Subjects within groups were randomly assigned to experimental conditions in a $2 \times 2 \times 2$ factorial design with the independent variables: (1) time pressure (high versus low); (2) evaluation apprehension (high versus low); and (3) informational sequence depicting a target person's behaviors in a work-related context. In one condition positive information about the target person was presented first followed by negative information (positive-negative sequence). In the second condition, negative information was presented first followed by positive information (negative-positive sequence). The subjects' task was to judge the target person's likelihood of succeeding at a new job.

Procedure

Each subject received typewritten text including a description of the experimental task and manipulations of the independent variables. An introductory paragraph emphasized the importance of developing new personnel-selection methods in various organizations. The experimental task was portrayed as representing a particular selection method based on predicting a candidate's success at a job from this person's behaviors in a previous work situation. Specifically, the subjects had to predict a given person's future success as a president of a company from listening to a tape-recorded sequence of this person's on-job behaviors as a department head. The subjects then rated the candidate's likelihood of succeeding at the job on a scale ranging from 0 (not at all likely to succeed) to 10 (very likely to succeed).

Manipulating evaluation apprehension. In the high-evaluation-apprehension condition subjects were informed that the present research examines the ability to successfully predict

another person's success at work. It was noted that such a predictive ability is of considerable importance so it is useful to know the extent to which one possesses this particular ability. The subjects were informed that following task completion they would have to explain their predictions to other members of their group, and that their judgments would be compared with the target person's actual degree of job success as indexed by various objective criteria.

In the *low-evaluation-apprehension* condition subjects were informed that the selection method being investigated is at a pilot stage, and its validity is not yet well known. Subjects were also informed that "because of professional ethics" they would not be able to find out how well the target person actually did do at the new job, nor could they expect to find out how he was judged by other members of their group.

In the *high-time-pressure* condition subjects were informed that after listening to the tape-recorded sequence they would be given 3 min within which to complete their predictions. It was explained that a time constraint constitutes an essential element of the selection method under study. The passage of time was made vivid by means of a stopwatch visibly held by the experimenter during the experimental session. Indeed at the end of 3 min the experimenter proceeded to collect the response sheets from the subjects.

In the *low-time-pressure* condition the subjects were informed that after listening to the recorded sequence they would have an unlimited time within which to complete the predictive task. There was no indication of time measurement and the experimenter collected the subjects' response sheets at the end of 1 hr.

The recorded sequence. As noted earlier, the recorded sequence to which the subjects listened consisted of two parts. In one part the target person was portrayed in a positive light and in the second part in a negative light. Specifically, the positive part included behavioral events suggesting the target person's interest in the employees performance and their welfare, courtesy to their clients and sensitivity to client needs, orderliness, and efficiency, as well as persuasiveness and leadership at a business conference. The negative part contained behavioral events suggesting the target person's inattentiveness to employee problems and a rejecting attitude toward their requests, wastefulness and inefficiency at troubleshooting, personal disorganization, and a lack of persuasiveness at a business conference. As mentioned earlier half of the subjects listened to the positive sequence first followed by the negative sequence and the other half listened to the negative sequence first followed by the positive sequence.

After the subjects made the requisite success ratings they were thoroughly debriefed and the experimental deceptions were disclosed to them. This concluded the experiment.

Results

Judgments in the *positive-negative* sequence were generally more positive than those in the *negative-positive* sequence ($F(1, 72) = 100.53; p < .01$).¹ This suggests that a general *primacy effect* was obtained. To analyze the primacy effects across the informational sequences a scale reversal was performed on scores in the *negative-positive* sequence. Insofar as informational sequence did not significantly interact with time pressure or evaluation apprehension we collapsed the data across the two informational sequences. These combined data are displayed in Table 1.

An analysis of variance performed on these results yielded two main effects and an interaction. Specifically, primacy effects were significantly more pronounced when time pressure was high rather than low ($F(1, 76)$

¹ All p values reported are two-tailed.

TABLE 1
MEAN^a PRIMACY EFFECTS^b

Degree of time pressure	Evaluation apprehension	
	High	Low
High	7.05	7.9
Low	4.9	7.5

^a Data collapsed across the two informational sequences after the ratings in the negative-positive sequence were subjected to the appropriate scale reversals to allow for the combined testing for primacy effects.

^b The higher the numbers the stronger the primacy effects.

= 16.36; $p < .01$) and when the evaluation apprehension was low rather than high ($F(1, 76) = 32.06$; $p < .01$). Finally, the difference between the time-pressure levels was greater when evaluation apprehension was high versus low ($F(1, 76) = 8.48$; $p < .01$).

Thus, the present data are consistent with the idea that primacy effects in impression formation reflect epistemic freezing and are appropriately influenced by the determinants of freezing such as the epistemic motivations for structure and the avoidance of invalidity, at least as these are represented by the degrees of time pressure and evaluation apprehension, respectively.

EXPERIMENT 2: ETHNIC STEREOTYPING

In our second experiment we attempted to see whether an epistemic analysis of the freezing phenomenon may not apply also to ethnic stereotyping. An ethnic stereotype exists when a person perceives a given member of an ethnic group in terms of a generalized notion of the group as a category rather than in terms of specific information concerning the individual member (for an extensive treatment of stereotyping see Hamilton, 1979). Ethnic stereotyping could be interpreted as an instance of epistemic freezing: An individual's conception of a given group could be decided on the basis of early information, and, be impervious to subsequent evidence inconsistent with this particular conception. If ethnic stereotyping reflects epistemic freezing it should be affected appropriately by the degrees of time pressure and evaluation apprehension. Just as with primacy effects, ethnic stereotyping should be more pronounced when time pressure is high versus low and when evaluation apprehension is low versus high. Furthermore, where the rendition of a judgment is ultimately required the time-pressure and evaluation-apprehension variables may be expected to interact: Variation of time pressure should have greater impact on ethnic stereotypes when evaluation apprehension is high as opposed to low.

Method

Subjects and Experimental Design

The subjects were 144 female students at a Teachers' seminary in the Tel-Aviv area. All were in their final year of studies and within 1 month of graduation and receipt of their teaching diploma. Of the students 105 were of an Ashkenazi (Occidental) origin; their families had come to Israel from Europe or America. The remaining 39 students were of a Sepharadi (Oriental) origin; their families had come to Israel from Asia or Africa. The present experimental paradigm was adopted from Guttman and Bat-Tal (1982). In this particular paradigm, subjects assign grades to a composition written by a person of a given ethnic identity. Insofar as there were no significant differences in grade assignments made by Ashkenazi-versus-Sepharadi subjects their data were combined and analyzed collectively.²

The subjects were tested in groups of five to seven persons. Subjects within groups were randomly assigned to cells of a $2 \times 2 \times 3$ factorial design in which the independent variables were (1) degree of time pressure (high versus low); (2) degree of evaluation apprehension (high versus low); and (3) the target person's ethnic identity (Ashkenazi, Sepharadi, and ethnically unidentified). Each of the 12 cells in the above design contained 12 subjects.

Procedure

Each subject received a set of typewritten sheets introducing the experimental task and manipulating the independent variables. The introduction, common to all subjects, stated that "evaluation of students' achievements is an essential part of a teacher's job" and that the experimental task consists of evaluating a Hebrew composition written by an 8th grader (the composition's topic being "an interesting event that happened to me"). The sheets given to subjects also included the written composition, some background information about the writer, and a rating scale on which the composition was to be graded for literary excellence. The scale ranged from 40 points (indicating failure) to 100 points (indicating excellent performance).

Manipulating evaluation apprehension. In the *high-evaluation-apprehension* condition the subjects' text stated that the research is intended to assess the teachers' evaluative ability prior to their graduation. The subjects were led to believe that each will have to explain her grade assignment to other members of the group. In addition, the subjects were informed that at the end they would be able to ascertain their evaluative ability *via* comparing their grade assignment with that made by a team of experienced teachers evaluating the same composition.

In the *low-evaluation-apprehension* condition the subjects' text indicated that evaluating achievements in humanistic domains is inherently difficult in the absence of clear-cut criteria for what constitutes quality in such domains. It was explained that when it comes to humanistic subjects there are no right or wrong evaluations and that the purpose of the research is not to assess correctness but rather to identify possible individual differences in evaluative style.

² The absence of judgmental differences between Ashkenazi and Sepharadi subjects might seem contrary to our "conclusional-need" hypothesis, which could be interpreted to suggest that the Sepharadi subjects should rate the Sepharadi writer's product as more positive than the Ashkenazi subjects, with the reverse being the case for the Ashkenazi writer's product. But it is difficult to know precisely what may have been the Sepharadi subjects' needs in the present conditions. For instance, at least some subjects may have identified with the high status group and others might have "bent over backwards" to appear objective. To the extent that such needs were present they could well account for the lack of judgmental differences between Ashkenazi and Sepharadi subjects.

Manipulating time pressure. In the *high-pressure* condition the subjects were informed that because of scheduling problems the experiment had to be completed within 10 min. Indeed, at the end of 10 min the experimenter collected the subjects' response sheets and left the room. In the *low-pressure* condition the subjects were informed that they had a full hour at their disposal. In this condition, the experimenter collected the subjects' response sheets at the end of 1 hr from the beginning of the experiment.

The writer's ethnic identity. In one experimental condition (the Ashkenazi condition) the background information about the writer stated that his name was Isaac Blumenthal and that his father's birthplace was Poland. In a second experimental condition (the Sepharadi condition) the writer's name was alleged to be Isaac Abutbull (a typical Moroccan name) and his father's birthplace was Morocco. In a third experimental condition (the ethnically unidentified condition) the writer was only identified by his first name (Isaac) without any information being given about the father's birthplace, etc. To add realism, in all experimental conditions the writer was identified as an 8th grader, a resident of Tel-Aviv, born in 1969, and attending the "Meginim" public school. In fact, the composition was prepared by an 8th-grade Hebrew teacher as an example of what a reasonable composition by an 8th grader might look like.

After the subjects completed the task they were fully debriefed and the experimental manipulations and deceptions were explained to them.

Results

The subjects' grade assignments are summarized in Table 2. Grades assigned to the Sepharadi and unidentified writers were remarkably close in all the experimental conditions; they were, therefore, combined and displayed collectively.

As can be seen, the Ashkenazi writer is assigned systematically higher grades than the Sepharadi or the unidentified writers. The main effect for the writer's identity is highly significant ($F(1, 136) = 165.53$; $p < .01$) replicating the strong stereotyping effects reported by Guttman and Bar-Tal (1982).

TABLE 2
MEAN GRADE ASSIGNMENTS AS FUNCTION
OF TIME PRESSURE, EVALUATION APPREHENSION, AND WRITER'S
ETHNIC IDENTITY

Ethnic identity	Epistemic motivation			
	High evaluation apprehension		Low evaluation apprehension	
	High time pressure	Low time pressure	High time pressure	Low time pressure
Ashkenazi	79.58 ^a	65.00	81.25	80.00
Sepharadi or unidentified	63.74	63.95	64.37	63.33

^a The grades were recorded on a scale ranging from 40 points, representing failure, to 100 points, representing excellent performance.

More interesting from the present vantage are the effects on stereotyping of time pressure and evaluation apprehension indicated by the appropriate two- and three-way interactions. Specifically, the two-way interaction between the time-pressure variable and the writer's identity is statistically significant ($F(1, 136) = 14.78; p < .01$). A breakdown of this interaction given in Table 3 indicates that the Ashkenazi writer is assigned a higher grade when the time pressure is high as opposed to low whereas the time-pressure levels seem to have no effects on grades assigned the Sepharadi or unidentified writer. Earlier we noted that stereotypic judgments expressed themselves primarily in higher grade assignments to the Ashkenazi writer. Thus, the high (versus low) time pressure appears to significantly enhance the tendency toward stereotyping judgments just as suggested by the present epistemic analysis.

Furthermore, the two-way interaction between evaluation apprehension and the writer's ethnic identity is statistically significant ($F(1, 136) = 18.25; p < .01$). A breakdown of this interaction given in Table 4 indicates that the grade assigned to the Ashkenazi writer is lower in the high-apprehension condition as compared with the low-apprehension condition, whereas the evaluation-apprehension levels seem to make little difference to grades assigned the Sepharadi or unidentified writer. Thus, the high (versus low) evaluation appears to significantly reduce the stereotyping effect, as predicted by the present epistemic analysis.

Finally, the three-way interaction between time pressure, evaluation-apprehension, and the writer's ethnic identity is statistically significant ($F(1, 136) = 13.97; p < .01$). A breakdown of this interaction given in Table 2 indicates that when evaluation apprehension is high, a high-versus-low degree of time pressure results in higher grade assignments to the Ashkenazi writer. Furthermore, the time-pressure levels have no apparent effects on grade assignments to the Sepharadi or the unidentified writer. Indeed, the two-way interaction between time pressure and the writer's identity at the *high evaluation-apprehension level* is statistically significant ($F(4, 132) = 7.03; p < .01$). However, at the *low evaluation-apprehension level* the time-pressure levels do not make any appreciable

TABLE 3

MEAN GRADE ASSIGNMENTS AS FUNCTION OF TIME-PRESSURE LEVELS AND WRITER'S ETHNIC IDENTITY

Ethnic identity	Time pressure	
	High	Low
Ashkenazi	80.41	72.50
Sepharadi or unidentified	64.06	63.65

TABLE 4
MEAN GRADE ASSIGNMENTS AS FUNCTION OF EVALUATION-APPREHENSION LEVELS AND
WRITER'S ETHNIC IDENTITY

Ethnic identity	Condition	
	Fear invalidity	
	High	Low
Ashkenazi	72.29	80.62
Sepharadi or unidentified	63.85	63.85

difference to grade assignments regardless of the writer's identity. The appropriate two-way interaction between time pressure and the writer's identity at the low evaluation-apprehension level is far from significant ($F = .005$). Thus, as predicted by the present epistemic analysis time pressure and evaluation apprehension exert an interactive effect upon stereotypic judgments; the time-pressure variations have greater effect when the evaluation apprehension is high versus low.

So far, our epistemic analysis of freezing and unfreezing received support in experimental paradigms concerning disparate contents of social judgments: Judgments concerning first impressions of another person and of those concerning the stereotypic evaluation of another person's product. But the present epistemic analysis should generalize to judgments whose contents are not necessarily social. The next experiment in our series was explicitly designed to address this possibility.

EXPERIMENT 3: NUMERICAL ANCHORING

Tversky and Kahneman (1974) identified the tendency of numerical estimates to be anchored at initial values without being sufficiently adjusted in the light of subsequent calculations. For example such a tendency could lead to the overestimation of the probabilities of conjunctive events and to the underestimation of the probabilities of disjunctive events. A conjunctive event is defined as an intersection of several simple events with given probabilities. For example, consider the drawing (with replacement) of n marbles from an urn containing the proportion q of red marbles. A conjunctive event ($\times$) would be, for example, coming up with a red marble on every single draw. The probability $p(\times)$ of such an event can be calculated from the formula $p(\times) = q^n$. Insofar as q is a fraction of some size, multiplying it by itself n times yields values which decrease with increase in n . Thus, the subjects are likely to overestimate $p(\times)$ to the extent that their judgments are anchored at initial values suggested by the size of q .

While for a conjunctive event to occur the constituent simple events must all take place, for a disjunctive event to occur suffice it if at least one in a series of simple events took place. Returning to our example of n draws from an urn containing the proportion q of red marbles, an exemplary disjunctive event (y) would be coming up at least once out of n draws with a red marble. The probability of such an event is $p(y) = 1 - (1 - q)^n$. This quantity increases as a function of n . Thus subjects are likely to underestimate $p(y)$ to the extent that they are anchored at initial values suggested by q .

To demonstrate empirically the phenomenon of anchoring Bar-Hillel (1973) asked subjects to choose within pairs of events the one which is more likely to occur. Some pairs contrasted conjunctive events with simple events while other pairs contrasted simple events with disjunctive events. The q 's of the constituent conjunctive events were in all cases larger than those of the yoked simple events; however, the final conjunctive probabilities were invariably smaller than those of the yoked simple events. The initial probabilities of the disjunctive events were in all cases smaller than those of the yoked simple events, yet the final disjunctive probabilities were in all cases larger. Under these circumstances Bar-Hillel (1973) was able to obtain impressive support for the anchoring phenomenon. As predicted, the subjects tended to significantly overestimate the probabilities of conjunctive events and to underestimate those of disjunctive events.

According to the present analysis, the anchoring phenomenon can be viewed as an instance of epistemic freezing in which the subjects' epistemic activities are frozen after an initial estimate is generated and slightly adjusted. Beyond this point subjects may refrain from *attending* to further relevant evidence and from revising their judgments in light of such evidence. If our analysis is correct the anchoring phenomenon should be more pronounced under a high-versus-low time pressure and under a low-versus-high evaluation apprehension. Furthermore, according to the logic explicated earlier the time-pressure variations should have greater impact upon anchoring when the evaluation apprehension is high rather than low.

Method

Subjects and Experimental Design

One hundred and twenty high school students (male and female) from the Tel-Aviv area participated as subjects. They were all in their final year of high school (the 12th grade) and had had a degree of exposure to elementary probability theory. Sixty subjects participated in each of two separate subexperiments. In one subexperiment the subjects chose between simple and conjunctive events and in the second subexperiment, between simple and disjunctive events. The specific event pairs included each of the two subexperiments that were adopted from Bar-Hillel (1973) and are given in Table 5.

In each of the subexperiments all subjects responded to all event pairs. Also, in each of the experiments the subjects were tested in groups of six to nine persons. Subjects

TABLE 5
PAIRS^a OF COMPOUND (CONJUNCTIVE OR DISJUNCTIVE) AND SIMPLE EVENTS IN TWO
SUBEXPERIMENTS

Event pair	Subexperiment			
	1		2	
	Conjunctive event	Simple event	Disjunctive event	Simple event
1	.7 ² = .490	.50	.1 ₇ = .522	.50
2	.9 ⁹ = .387	.40	.2 ₆ = .738	.70
3	.6 ² = .360	.40	.3 ₅ = .832	.80
4	.8 ⁷ = .210	.25	.4 ₅ = .922	.90
5	.5 ⁴ = .062	.10	.1 ₉ = .613	.60
6	.9 ⁷ = .478	.50	.2 ₈ = .832	.80
7	.5 ² = .250	.30	.3 ₇ = .918	.90
8	.75 ⁶ = .178	.20	.5 ₄ = .938	.90

^a Adopted from Bar-Hillel (1973).

within groups were assigned randomly to the cells of a 2 × 2 factorial design with the independent variables of (1) time pressure (high versus low) and (2) evaluation apprehension (high versus low). All instructions and manipulations were accomplished *via* typewritten text provided to subjects. In all cases the experiment was described as testing a new educational game concerned with betting behavior. Each subject addressed eight pairs of bets and chose in each case the more likely bet in the pair.

Manipulating evaluation apprehension. Subjects in the *high-evaluation-apprehension* condition were informed that all pairs of bets were taken from an exam in advanced statistics. The subjects were told that after they make their choices the experimenter will write the right answers on the blackboard and each subject will be asked to state how many correct choices he/she made. It was explained to subjects that in this way they would be able to evaluate their personal level in statistics relative to the other members of the group. In the *low-evaluation-apprehension* condition the subjects were informed that because of a time shortage the researchers will not be able to check on the correctness of each subject's answers. It was further stated that the researchers are interested in group averages rather than in individual achievements.

Manipulating time pressure. In the *high-time-pressure* condition it was explained to subjects that in the betting game under study, the time element is of the essence. Correspondingly, the subjects were informed that they had at their disposal 3 min to complete their choices. In the *low-time-pressure* condition the subjects were told that they have unlimited time to complete their task.

Following these manipulations each subject responded to eight pairs of bets in an order individually randomized for each respondent. After having done so the subjects were debriefed and the various deceptions used were fully revealed.

Results

Subjects' choices in the various experimental conditions are summarized in Tables 6 and 7.

As can be seen in Table 6 the proportions of the choosing conjunctive over simple events, indicative of the anchoring effect, are higher in the

TABLE 6
PROPORTIONS OF CHOOSING CONJUNCTIVE OVER SIMPLE EVENTS IN SUBEXPERIMENT 1

Time pressure	Evaluation apprehension	
	High	Low
High	.525	.575
Low	.325	.566

high-versus-low time-pressure condition. The corresponding main effect is significant statistically ($F(1, 56) = 8.15$; $p < .01$). Furthermore the proportions of conjunctive (versus simple) choices are *lower* in the *high-versus-low* evaluation apprehension conditions (main effect of fear invalidity, $F(1, 56) = 16.57$; $p < .01$). Finally, the time-pressure variations exert a greater effect on choosing conjunctive-versus-simple events under high-versus-low evaluation-apprehension (interaction of time pressure and evaluation apprehension, $F(1, 56) = 7.84$; $p < .01$). Highly similar effects appear in Table 7 where anchoring effects are indexed by the proportions of choosing simple over disjunctive events. Those proportions are higher under high-versus-low *time pressure* (main effect of time pressure, $F(1, 56) = 8.86$; $p < .01$) and are lower under high-versus-low evaluation-apprehension (main effect of evaluation apprehension, $F(1, 56) = 7.56$; $p < .01$). Furthermore, the time-pressure variations have greater effect on choosing simple over disjunctive events when the evaluation apprehension is high versus low (interaction of time pressure $\times$ evaluation apprehension, $F(1, 56) = 4.47$; $p < .05$).

GENERAL DISCUSSION

As predicted by our epistemic analysis, primacy effects in impression formation, stereotypic evaluations, and numerical anchorages were all more pronounced when the degree of evaluation apprehension was high versus low. Furthermore, the time-pressure and evaluation-apprehension variables interacted as expected in all of our experiments such that time pressure had greater impact on all of the presently studied phenomena when the evaluation apprehension was high versus low.

TABLE 7
PROPORTIONS OF CHOOSING SIMPLE OVER DISJUNCTIVE EVENTS IN SUBEXPERIMENT 2

Time pressure	Evaluation apprehension	
	High	Low
High	.516	.541
Low	.316	.508

The above results are consistent with the idea that primacy effects, stereotypic judgments, and numerical anchorages all represent "epistemic freezing;" in particular, each of these phenomena seemed to be affected in the same way by factors theoretically relevant to "freezing," notably by the need for structure presently manipulated *via* degrees of time pressure and by the fear of invalidity presently manipulated *via* evaluation apprehension.

Process Similarities

The present data suggest that several phenomena that might seem as quite disparate and unrelated share important underlying commonalities. Take, for example, numerical anchoring investigated in our third experiment. At first glance, this phenomenon may seem quite remote from primacy effects and stereotyping investigated in our first and second experiments. Furthermore, the observed effects of time pressure and evaluation apprehension on anchoring might seem quite different in kind from the effect on primacy and stereotyping phenomena: It seems intuitively plausible that under time pressure and/or when being right is not very important subjects would be unable and/or unmotivated to perform the calculations required for getting the right answer. This explanation readily accounts for the effects of our variables on anchoring, but can it also apply to primacy and stereotyping effects?

According to the epistemic analysis in all our studies the experimental tasks required the performance of various deductive operations on externally provided information. Time pressure was expected to inhibit, and evaluation apprehension to enhance, the process of attending to the information and/or deducing from it various implications relevant to the requisite judgments. What differed between our experiments were the *contents* of the specific deductions to be performed. In the impression-formation task of study 1 the relevant deductions had to do with the subjects' concept of "job-success" deducible as it may be from various items of information about the target person. In the product-evaluation task of study 2, subjects deduced the excellence of literary performance from various aspects of the target person's composition and, in the numerical-estimate task of study 3, subjects deduced (or calculated) a given quantity from numerical information relevant to that particular quantity. Now undoubtedly there exist many differences separating the numerical deductions of study 3, from the social ("success") or aesthetic ("literary excellence") deductions of studies 1 and 2. For instance, numerical deductions seem more objective or at least consensual (*any* educated person knows that $4 \times 4 = 16$, etc.) than social or aesthetic deductions, the latter being typically determined by reference to more subjective criteria. But from the present standpoint such differences have to do with the *contents* of judgments (numerical-versus-social or aesthetic)

rather than with the judgmental process which as our data suggest, may be invariant across judgmental contents.

While quite encouraging, the present results may not be considered as conclusive evidence for the hypothesized effects on epistemic freezing of the needs for structure and the avoidance of invalidity. A major difficulty is that in all our three studies the specific manipulations of the relevant epistemic variables were highly similar. In particular, the need for structure was invariably manipulated *via* time pressure and the fear of invalidity, *via* evaluation apprehension aroused by the implied loss of face in case of a judgmental mistake. Further research is thus needed to demonstrate that alternative operationalizations of the same epistemic motivations would produce the same effects. For example, need for structure could be heightened by means of instructions stressing the value of clear-cut, unambiguous judgments. Similarly, need for structure could be lowered by means of instructions stressing the value of complexity and differentiation and/or disparaging oversimplification or overgeneralization. Furthermore, while in the present studies the fear of invalidity was manipulated *via* engaging the subjects' need for self-esteem, the same fear could be aroused by linking judgmental mistakes with threats to alternative needs, say economic needs, physical safety needs, etc.

Mediating Mechanisms of Motivational Effects

1. The Discounting Phenomenon

The present experimental findings are open to a number of interpretations that, on first glance at least, might appear to differ from our epistemic analysis. Specifically, Anderson and Jacobson (1965) showed that sometimes primacy effects may occur because of the tendency to discount later information inconsistent with an early information. It is thus possible that under a high degree of time pressure the tendency to discount later information is augmented resulting in the pronounced freezing observed in the high (versus low) time-pressure conditions of the present research. In order to see more precisely how the above interpretation relates to the epistemic analysis let us consider more closely Anderson's and Jacobson's notion of discounting.

First, as already noted, discounting is assumed to occur when different items of information are inconsistent with one another. Furthermore, Anderson and Jacobson hypothesized and found that in informational triads in which two items were consistent with each other and were both inconsistent with a third item, it was the latter item which tended to be discounted. Finally, Anderson and Jacobson found that the discounting effect was augmented when subjects were led to believe that some of the informational items were implied to be (1) of a dubious validity or (2) inapplicable to the judgment being rendered.

It is noteworthy that all the above features of "discounting" are highly compatible with our epistemic theory, and in particular with its assumptions that (1) inconsistency is resolved *via* denying (or discounting) one of the inconsistent cognitions and that (2) denial is likely to be directed at the apparently less credible of the contradictory cognitions. For instance if two informational items are mutually consistent they cross-validate each other rendering the third inconsistent item less apparently credible and, hence, more likely to be discounted or denied. This tendency may well be augmented when some of the items are *a priori* known to be less valid than others. Furthermore, our lay epistemic analysis assumes that only information perceived as relevant or applicable would be considered when making a judgment. Implying (as did Anderson & Jacobson (1965)) that a given item of information is not relevant or applicable understandably reduces the tendency to take the item into account.

Finally, the lay-epistemic theory suggests that a heightened need for structure would enhance the tendency to resolve an inconsistency (preventing the attainment of structure). Thus, a heightened need for structure could well enhance the tendency to deny (discount) the inconsistent items of information in particular if they are considered as less valid than their opposing counterparts.

In short, the epistemic analysis is fully compatible with previous theory and findings concerning the discounting phenomenon (cf. Anderson & Jacobson, 1965). It also suggests that "discounting" may be particularly likely to occur under a heightened need for structure manipulated, for example, *via* a high degree of time pressure but also *via* other possible means.

2. Attentional Increments

Anderson (1976) theorized that primacy effects may occur because of attentional decrements to successive items of information. In line with this analysis Anderson (1976) reported that primacy effects were eliminated in conditions where subjects were instructed to attend to all the informational items including those presented late in the series. Similar attentional increments could well be present in the high-apprehension conditions of our research and, underly, the unfreezing effects observed in these conditions. In this sense, an "attentional increment" explanation is not incompatible with our "fear of invalidity" explanation. Rather, attentional increments could *mediate* fear-invalidity effects upon judgments. It is also well to note that according to the present analysis attentional increments *as such* are insufficient for a judgmental unfreezing to occur: Unfreezing is assumed to occur *providing* the attentional increments are aimed at improving the validity of one's judgments. Without such a guiding concern, attention might well be directed at irrelevant aspects of the information. Alternatively, new information could be attended to

in an isolated fashion without it being brought to bear on previously formulated judgments. The above discussion suggests the need to refine the lay epistemic theory and to more specifically characterize the mediating mechanisms whereby the various epistemic motivations may exert their effects upon judgments.

Unfreezing Versus Rectifying

A simple interpretation of the present findings may depart from the assumption that the freezing of inferences represents a source of error; therefore factors like a lack of time pressure or a perceived importance of judgmental accuracy may be exerting a *rectifying* influence, and reduce the tendency to err. Such an interpretation is strongly at variance with our epistemic analysis of freezing and unfreezing. More specifically, we do not posit a systematic relation between the freezing or unfreezing of judgments on the one hand and judgmental accuracy on the other hand. According to our analysis, one's initial impressions could occasionally be "correct" in some sense, whereas further information that one might encounter could be of dubious "validity." In such circumstances, of course, stubbornly freezing on an initial judgment might result in a more correct inference than unfreezing and modifying the judgment in the light of incoming information. In short, allowing one ample time to complete a judgmental task and/or imploring one to be accurate need not improve the validity of inferences and might occasionally detract from inferential validity (for the details of this argument see Kruglanski & Ajzen, 1983).

Epistemic Analysis of Belief Perseverance

The foregoing discussion addresses some of the difficulties and alternative interpretations encountered by the present epistemic analysis of freezing and unfreezing. Without belittling the need for further research probing the validity of those competing alternatives it is well to point out that the epistemic analysis seems capable of ordering several previous findings on the phenomenon of "belief perseverance," viewed here as another instance of epistemic freezing. An individual is said to persevere with a belief when (s)he continues to subscribe to it despite discrediting evidence concerning the belief in question. For example, in research by Ross, Lepper, Strack, and Steinmetz (1977), the subjects' tendency to persevere with their beliefs about certain fictitious events was strengthened by instructions to provide causal explanations for those events. This could reflect a need for structure heightened by a requirement to *explain* the events, that is, imbed them in specific causal structures. Fleming and Arrowood (1979) also found an increase in perseverance under instructions to causally explain a given event: they further found a decrease in perseverance where subjects were distracted from thinking about the event, a condition which may well have reduced their need for structure concerning the event.

In an experiment by Lord, Ross, and Lepper (1977) subjects regarded as more reliable studies supporting their own position as compared to opposing studies. This could reflect the working of a conclusional need having to do with the subject's self-esteem. To the extent that the subject's self-esteem in the experimental situation hinged on being right they might find it pleasing to have their opinions confirmed and displeasing to have them disconfirmed. This could dispose the subjects to generate alternatives to the disconfirmatory conclusions and refrain from generating alternatives to the confirmatory conclusions. Finally, in the study by Ross, Lepper, and Hubbard (1975) belief perseverance was completely eliminated in a "process-debriefing" condition in which the subjects were specifically forewarned about perseverance and alerted to its possible dangers. This condition might well have heightened the subjects' fear of invalidity thus having sharpened their sensitivity to the debriefing information inconsistent with the original beliefs.

The present epistemic analysis ramifies to numerous additional topics in social cognition. In these closing paragraphs we should like to briefly mention a few. Consider, for example, Snyder's recent research on the confirmatory bias in hypothesis testing (cf. Snyder & Swann, 1978; Snyder & Gangestad, in press). In the experimental situations created by Snyder and his colleagues subjects were generally more sensitive to confirmatory evidence for a given hypothesis than to disconfirmatory evidence. But it seems appropriate to ask about the conditions under which confirmatory-versus-disconfirmatory evidence would be preferred as opposed to conditions under which the reverse might occur. For example, the present epistemic analysis suggests that subjects might be particularly sensitive to disconfirmatory evidence when their fear of invalidity is aroused or when the hypothesis being tested is highly incongruous with their wishes and desires. By contrast, subjects might be particularly insensitive to disconfirmatory evidence when their need for structure is high or when the hypothesis being tested is highly pleasing.

Alternatively, consider the topic of group problem solving (cf. Davis, 1969). It seems plausible to speculate that in the early phase of group problem solving validity concerns might be particularly salient for the group members. Under those circumstances, group members might welcome divergent ideas inconsistent with the group consensus. But in a late phase of group problem solving, as the time to reach a decision draws near, structure needs may become more dominant. Under these conditions the group may be less tolerant of divergent proposals contraverting the emergent consensus.

Finally, consider the situation of the policy maker, say in government or business, as opposed to the outside consultant or advisor. To the extent that a great deal of decision making and action hinges on the established policies, the policy maker is likely to experience a high need for guiding structure. This might dispose the policy maker toward con-

servatism and close-mindedness to information inconsistent with the policy assumptions. By comparison, the outside advisor might have a relatively greater concern for the issue of validity and be more disposed to modify existing policies in the light of new information. Such divergent perspectives could promote ample conflict and misunderstanding between policy makers and consultants. Taking into account the differences in epistemic motivation could furnish one avenue of dealing with these differences and possibly contribute to a bridging of the gaps involved.

Suggestions in the last few paragraphs are admittedly speculative and in need of extensive empirical probing for their validation. They do, however, illustrate the heuristic potential of the epistemic analysis and the range of social psychological problems to which it may apply.

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REFERENCE NOTE

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