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Subjective Factors in Combat Simulation: Correlation between Fear and the Perception of Threat

R.A. Russell, J.R. Russell,
and K.K. Benke

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Maritime Operations Division
Aeronautical and Maritime Research Laboratory

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ABSTRACT

The gap in realism between a simulator for training and actual combat conditions is an issue requiring further attention. This preliminary study is the first part of a long term investigation aimed at developing quantitative methods for evaluating the effect of fear on combat performance. The relationship between subjective ratings of fear and the appearance and perception of threat were investigated using psychophysical experiments. It was found that fear was more strongly correlated with the perception of threat rather than the actual appearance of the threatening object. Data were used from experiments comparing observer ratings of a variety of animals known to evoke emotional responses in humans.

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Executive Summary

The performance of combat simulators may be improved if it were possible to include the effect of *emotional states* and *physiological conditions* (such as fear, anxiety, courage, smell or hearing). It has been reported that battlefield effectiveness is generally lower than the level predicted by trials and exercises. This may be due in part to the fact that data based on quantitative evaluations of combat performance rarely include detailed information on human factors.

Cognitive performance is known to be affected by the level of fear involved, and this has implications in many situations involving operator performance, such as air combat, land warfare and maritime operations. Fear itself is affected by such factors as the appearance or perception of threat. One may therefore assume that a relationship exists between perception of threat and battlefield performance.

This pilot study examines the relationship between subjective ratings of fear and the perception of threat. Analysis of results from psychophysical experiments indicates ratings of fear and perception of threat were found to be strongly correlated, whilst significant relationships also existed between the ratings of fear and appearance.

The results reveal that the perception of threat has a much greater effect on the level of fear than the actual physical appearance of the threatening object. This suggests that fear is internally generated and egocentric, and related to coping ability, a finding consistent with the human response to occupational stress. Data were used from psychological experiments comparing observer ratings of a variety of animals known to evoke emotional responses in humans.

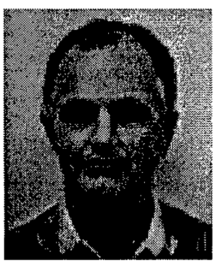
If a statistical relationship can be demonstrated between fear and the appearance and perception of threat at the laboratory scale, then there is scope for examination of this dependence (if it still exists) at a larger scale which could involve monitoring Defence personnel under conditions of real or simulated threat. Such a study would be a precursor to evaluating the decline of combat performance in threatening situations. The effect of morale on performance was not addressed here, but it is clear that there is a possible link at a higher level of abstraction.

Authors

R.A. Russell

Rachelle Russell is currently engaged in a study through Monash University, Gippsland Campus, in psychology and is interested in the applications of cognitive science, human factors and ergonomics.

J.R. Russell
Ship Structures and Materials Division



John Russell is qualified at the level of Associate Diploma in Applied Science. He has extensive experience in photographic laboratory practice, electron microscopy and X-ray energy analysis. His interests include improving the visual presentation of data at the man-machine interface and practical applications of energy dispersive analysis. He is currently engaged in activities involving materials research, including analysis of defective components and improving the transfer of electron microscopic imagery to hardcopy.

K.K. Benke
Maritime Operations Division

Kurt Benke is a Senior Research Scientist and project manager with the Maritime Operations Division. He received BSc and MSc degrees in Physics from Melbourne University, a PhD in Mathematics and Computer Science from Deakin University and a postgraduate Diploma in Applied Statistics from RMIT. At the Kodak Research Laboratory he carried out theoretical and experimental research in optical physics, X-ray physics and electromagnetic scattering in halide microcrystals. He has private enterprise experience in market research, strategic planning, financial analysis and quality assurance. DSTO research experience includes studies in human perception, computer vision, neural networks, automatic target recognition, mathematical optimisation and texture analysis. He is currently engaged in sonar system optimisation by operations research, signal processing and human factors analysis.

Contents

1. Psychology of Fear

The question of whether humans and animals are in some way biologically programmed to behaviour that enhances survival in their natural environment has prompted a number of laboratory experiments. Psychophysical experiments are an approach designed to rank or quantify fearful situations on the basis of so-called psychometric analysis (Boff and Lincoln 1988, Green 1990, and Treutwein 1995).

The suggestion that certain fears are *innate* has been put forward in an attempt to rationalise fears of dangerous animals. For example, Seligman (cited in Coon 1989) advanced the theory that some fears are easier to learn than others, and that humans are conditioned by evolution to readily develop fears to particular stimuli, such as reptiles and arachnids. Seligman believes that our readiness to learn such fears makes humans highly resistant to extinction.

Experiments which have supported the idea that people are more prepared to learn to be afraid of certain objects over others have commonly been based on fear that was conditioned in subject volunteers using a variety of prepared conditioned stimuli (pictures of snakes or spiders) and unprepared stimuli (pictures of houses, faces or flowers). The pictures are followed by a brief, painful electric shock. Fear conditioning as measured by galvanic skin response, occurs much more rapidly to prepared stimuli than to unprepared ones. Conditioning occurs in one pairing of electric shock with images of snakes and spiders, but takes four or five pairings for the participants fear to be conditioned to faces, houses or flowers, (Ohman, Fredrikson, Hugdahl & Rimmo, cited in Atkinson 1985).

In one case, patients were asked to rate the characteristics of spiders that caused the most anxiety. These turned out to be size (the larger the worse); colour (the darker the spider, the greater the fear); hairiness (the more hairy, the more anxiety); movement (the more active, the worse it appeared) and proximity (the closer, the more fear). The descriptions of what the subjects feared about spiders focussed consistently upon the physical appearance.

Hinde (cited in Bennett-Levy and Marteau, 1984) argues that marked novelty and strangeness frequently evoke fearful behaviour (which is removed by using combat simulators, which can be both an advantage or disadvantage, depending on whether training efficiency or realism is required). The possibility exists that mechanisms similar to that proposed by Hinde might determine why human beings become fearful of the appearance of certain animals. With respect to the appearance of the animal, it has been suggested that visual characteristics may be related to the appraisal of the potential danger. The present study investigated the hypothesis that human beings, like animals, fear certain perceived characteristics, where ugly and harmful animals correlate with high ratings of fear, whilst attractive and harmless animals correlate with low ratings of fear. The principal hypothesis is that a relationship exists between the ratings of perception of threat (an indicator of harmfulness) and fear.

2. Stress and Combat Performance

Rowland (1996) reviewed historical reports on battlefield stress and combat performance, including recent studies on *combat degradation factors*. A quantitative knowledge of these degradation factors is a necessary part of any programme aimed at enhancing future capability. One degradation not usually considered in past studies is the *fear* induced by the combat environment. Sonar simulators and flight simulators, despite their technology and complexity (Figure 1), do not include feedback on the emotional or physiological state of the operator, and therefore cannot be entirely realistic (Figure 2).

Quantitative evaluations of combat performance require information on the effects of battlefield stress and this is unfortunately very rarely considered by methods engineers. Rowland notes also that battlefield effectiveness is significantly lower than the level suggested by trials and exercises. One presumes then that combat simulators will not necessarily provide optimum training if there is no allowance for such variables as fear, anxiety, courage, smell or hearing. Ideally, operators should also be monitored for pulse rate, blood pressure etc, and these variables correlated with training performance.

If fear affects combat performance, one important issue is whether appearance or perception of threat are important predictors. A psychophysical experiment provides a vehicle for a quantitative analysis that can later be applied to correlating fear with performance directly.

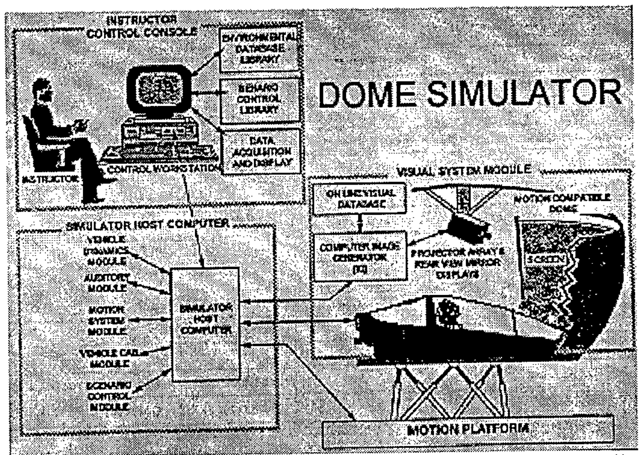
3. Experimental Method

3.1 Participants

The participants were students (n = 31, F 24, M 7) involved in first-year psychology enhancement education at the Gippsland Campus of Monash University. They were asked to complete three questionnaires shuffled in random order. The range of age between participants was from 16 years to 43 years.

3.2 Materials

The questionnaires were designed to measure the ranking of fear, threat and visual appearance of a number of small animals and insects. The same 29 animals and insects were listed on each of the questionnaires, where each of the animals were ranked using a three-point scale (1 = not; 2 = quite; 3 = very). Participants were asked to rank the threat of each animal, rating them as either not harmful, quite harmful or very harmful. Participants were also asked to rank appearance and fear under the same three point ranking scale.



(Schematic Diagram: Adapted from an original by Black (1995))

Figure 1. Complexity of a modern combat simulator showing motion-compatible half Dome system.

3.3 Design

The correlation study was designed to measure the self reported ratings of fearfulness, harmfulness and ugliness for each of the 29 animals.

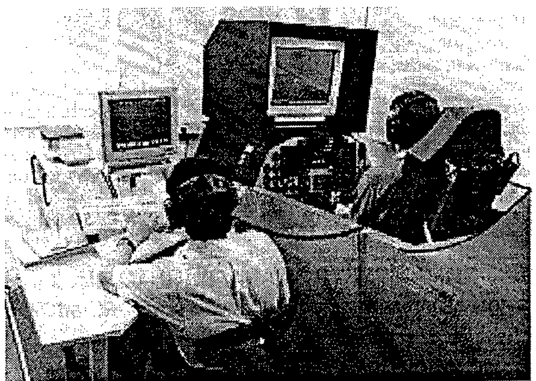
3.4 Procedure

Three questionnaires were administered to each participant and they were required to complete all of them. The participants were asked to shuffle the questionnaires in any order and rank each of the animals listed, according to how fearful, ugly and harmful they considered them.

Once the questionnaires were completed, the participant rankings of fear *vs* the appearance and perception of threat were collated as group total rankings. The mean ratings were then calculated.

4. Experimental Results

Figure 3 shows the ranking of fear for 29 animals (and the errors in the prediction for the independent variables of the multilinear regression model described in the Appendix). The mean ratings show that participants were more fearful of snakes and spiders than the other animals considered (see also Table 1). The rat, cockroach, crow, grass snake and lizard also rated high for fear, harmfulness (perception of threat) and ugliness (appearance); whilst the seal, butterfly, ladybird and lamb rated low for fear, harmfulness and ugliness.



(Photo: Israeli Aircraft Industries)

(Photo: Flight Safety International)

Figure 2. Top and bottom, typical combat simulators provide visual and audio inputs but do not include the effects of emotional or physiological states that may be present in actual combat situations.

The bivariate linear model produced a Spearman correlation coefficient of 0.94 and the following parameters; weighting for appearance 0.15, weighting for perception of threat 0.81 and a standard error of estimate of 0.12, with a model offset of 0.02. There is a statistically significant positive correlation at the 0.05 level of significance. Ratings for fear and the perception of threat (harmfulness) were highly correlated. The scattergram used to illustrate the relationship between fear and the perception of threat reveals the strong positive correlation existing between the two variables. The degree of the correlation displayed between fear and appearance is lower as shown by the larger errors.

5. Discussion

The results support the hypotheses that there is a strong correlation between the ratings of fear and perceived threat, and a weaker correlation exists between ratings of fear and appearance. The results indicate that the degree of threat posed by an animal is undoubtedly related to the fear of the animal. The connection between visual appearance, threat and fear may be that appearance can be seen as a danger signal eliciting a fear response. When interpreting the relationship between fearfulness and ugliness, it is clear that the appearance of an animal to a some extent affects the level of fear aroused. The stronger relationship between fear and harmfulness indicates that the extent of fear depends more upon the potential danger than appearance.

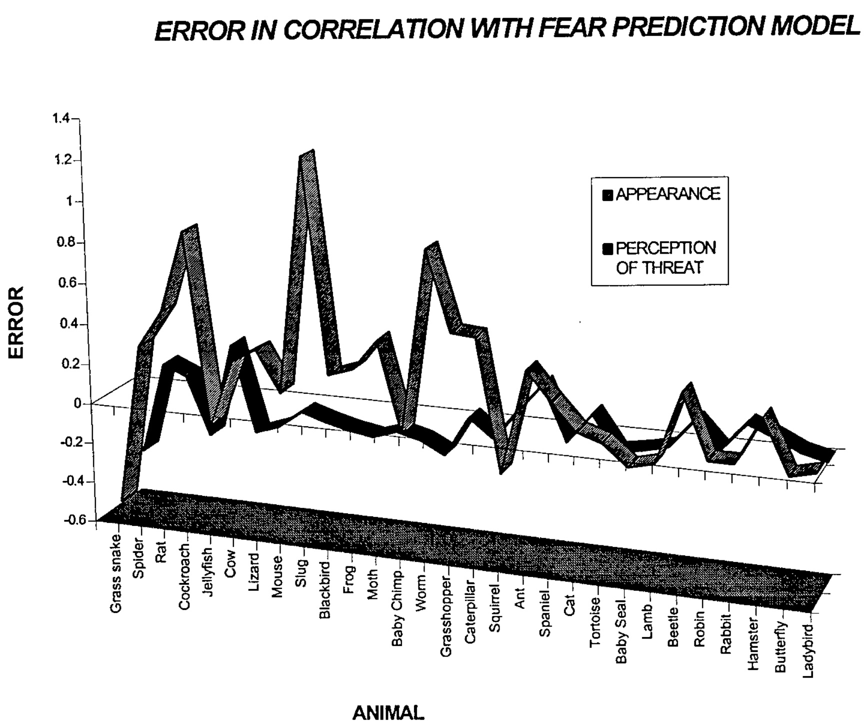


Figure 3. Plot of relative errors between fear and appearance, and fear and perception of threat. There is much greater correlation between fear and perception of threat. Animals are ranked in order of fearfulness according to experimental results.

Table 1. Mean ratings of Fear against Appearance and Perception of Threat

ANIMAL	APPEARANCE	PERCEPTION OF THREAT	FEAR
Jellyfish	1.64	1.97	1.70
Squirrel	1.00	1.23	1.14
Ant	1.51	1.37	1.14
Baby Seal	1.00	1.00	1.04
Lamb	1.03	1.03	1.04
Spaniel	1.37	1.10	1.14
Cat	1.20	1.21	1.10
Rabbit	1.03	1.14	1.00
Moth	1.61	1.09	1.17
Mouse	1.47	1.30	1.33
Hamster	1.26	1.09	1.00
Slug	2.52	1.17	1.24
Beetle	1.37	1.16	1.03
Butterfly	1.00	1.03	1.00
Rat	2.30	1.91	1.82
Baby Chimp	1.17	1.06	1.17
Lizard	1.71	1.25	1.37
Tortoise	1.15	1.03	1.09
Blackbird	1.47	1.12	1.22
Caterpillar	1.65	1.09	1.15
Ladybird	1.03	1.00	1.00
Grasshopper	1.67	1.19	1.16
Robin	1.06	1.03	1.03
Frog	1.47	1.06	1.18
Spider	2.47	2.31	2.17
Cow	1.88	1.45	1.61
Grass snake	1.81	1.99	2.31
Worm	2.06	1.00	1.17
Cockroach	2.61	1.53	1.73

Over the past twenty years psychologists have explained the fear of spiders by arguing that it results from evolutionary selection; that is, since some spiders are venomous, this acted as a catalyst to select for a disposition to fear such animals (according to Seligman (1971), Ohman (1986), as cited in Graham (1993)). Ware *et al*, however, as cited in Graham (1993), labelled a category of animals "fear relevant" because they evoke fear without being predatory - animals in this category include such animals as the lizard, rat, slug, snake and cockroach. It is unlikely that evolutionary conditioning to fear venomous or harmful animals relates to the fear of these animals, because it is difficult to conceive of the selection of pressures that would have been needed.

Only a linear hypothesis was examined and there may well be higher order non-linear effects. It is, however, clear that there is a significant correlation between fear and the perception of threat. A further criticism of the experiment is the strategy used in the collection of data, where participants are presented with a list of animals rather than being stimulated by images of the animals, which may have produced a more vigorous response. As the sample size was small, future replication would improve statistical confidence.

In summary, the study indicates a relationship between fear, perceived threat and visual appearance for the 29 animals considered. Such positive correlations indicate that the extent of fear of an animal can be estimated by the visual appearance and perceived threat, with the latter being the prime indicator.

6. Conclusion

6.1 Specific Comments

This pilot study examined the relationship between ratings of fear and the appearance and perception of threat. Participants (n = 31) provided subjective ratings on 29 animals according to the effect of appearance and threat on the level of fear engendered. Ratings of fear and perceived threat were found to be strongly correlated, whilst significant relationships also existed between the ratings of fear and appearance. These preliminary results suggest that there is a close association between perceived appearance, potential danger to others and the fear it provokes. In identifying such relationships, it is assumed that fear can be estimated from prior knowledge of perceived threat and appearance.

At a higher abstract level, translating these results to a hypothetical combat situation means that fear is dependent on both appearance and the perceived threat posed by the enemy, *but to different degrees*. Excessive fear engendered by one of these two factors is likely to affect combat performance (although the magnitude of this effect was not addressed in this study).

6.2 General Comments

If a statistical relationship can be demonstrated between fear and the appearance and perception of threat at the laboratory scale, then there is scope for examination of this dependence (if it still exists) at a larger scale which could involve monitoring Defence personnel under conditions of real or simulated threat. Such a study would be a precursor to evaluating the decline in combat performance in threatening situations. Research on emotional and physiological states and their effects on combat performance may also contribute to the future design of sonar and flight simulators.

The results show that the perception of threat has a much greater effect on the level of fear evoked than the actual physical appearance of the threatening object. This suggests fear is internally generated, or egocentric, and related to the coping ability of each individual. A logical implication is that there may be certain psychological attributes that are desirable for personnel who may be exposed to combat situations.

This is a basic study designed to stimulate further thought in this area and it is hoped that more involved experiments will be more closely aligned with human factors in Defence applications. Future experiments, under different operational scenarios, may involve having personnel "wired" with sensors (to monitor heart rate, respiration etc), much like an aircraft black-box, in order to compare physiological responses with measurements of performance.

7. References

Atkinson, R. (1985). *Introduction to Psychology (9th ed.).* New York: Harcourt Brace Jovanovich Publishers.

Bennett-Levy, J., & Marteau, T. (1984) *Fear of Animals: What is prepared?* **Brit. J. Psych.**, 75, 37-42.

Black, S. (1995) *Visual System Solutions for Land Vehicle Driving Simulators,* **Military Simulation and Training**, 5, 42-50.

Boff, K.R. & Lincoln, J.E (1988): *Psychophysical Methods,* **Engineering Data Compendium: Human Perception and Performance, 316-321**, 1542-1546.

Coon, D. (1989) *Introduction to Psychology (6th ed).* New York: West Publishing Company.

Draper, N. and Smith, H. (1966): *Applied Regression Analysis,* New York: John Wiley and Sons.

Flury, B. and Riedwyl, H. (1988): *Multivariate Statistics,* London: Chapman and Hall.

Graham, C.L. (1993). *The disgusting Spider: The role of disease and illness in the perception of fear of spiders.* London: City University.

Green, D. M. (1990): *Stimulus Selection in Adaptive Psychophysical Procedures,* **J. Acoust. Soc. Am., 87** 2662-2674.

McClave, J.T. and Dietrich, F.H. (1979): *Statistics,* San Francisco: Dellin Publ. Co.

Rowland, D. (1996): *The application of historical analysis to measure the effects of battlefield stress on performance in combat,* **J. Defence Science, 1,** 107-112.

Treutwein, B. (1995): *Adaptive Psychophysical Procedures,* **Vision Res., 35** 2503-2522.

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Appendix - Mathematical Modelling

The representation depicted below is based on the assumption that the independent variables are controlled or observed without error, the regression of y on x is linear, and the random deviations y_i - $E(Y|x_i)$ are mutually independent and follow a normal distribution with zero mean and common variance, $N(0,s^2)$:

$$E(Y|\, x_1, x_2, \dots, x_n) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n \tag{1}$$

A measured value y_i is the realisation of the random variable Y_i, which is equal to the expectation value (mean) given above plus a random deviation, e_i :

$$Y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_n x_{ni} + e_i \tag{2}$$

where i = 1, 2, ... , k and the regression coefficients must be estimated by minimising the error sum-of-squares, S, between the measurements y_i and the expectation value :

$$S = \sum_{i=1}^{n} (y_i - \beta_0 - \beta_1 x_{1i} - \dots - \beta_p x_{pi})^2 \tag{3}$$

The set of regression coefficients $\{\beta_0, \beta_1, \dots, \beta_p\}$ minimising S represents a p-dimensional hyperplane and can be determined by solving the following set of simultaneous equations with $(p+1)$ variables:

$$\frac{\partial S}{\partial \beta_0} = 0, \ \frac{\partial S}{\partial \beta_1} = 0, \ \dots , \ \frac{\partial S}{\partial \beta_p} = 0 \tag{4}$$

The least-squares estimates of the regression coefficients for the minimum value of S is the set $\{b_0, b_1, \dots, b_p\}$:

$$S_{\min} = \sum_{i=1}^{n} (y_i - b_0 - b_1 x_{1i} - \dots - b_p x_{pi})^2 \tag{5}$$

The parameter estimates are used in conjunction with the measurements to produce predictions for the linear model :

$$\hat{y}_i = b_0 - b_1 x_{1i} - \dots - b_p x_{pi} \tag{6}$$

The residuals given by $\hat{e}_i = y_i - \hat{y}_i$ represent the deviations between the measured and predicted values. The standard deviation of the residuals is often referred to as the standard error of the estimate (SEE) and is given by

$$s_r = \sqrt{S_{\min} / (n - p - 1)} \tag{7}$$

The coefficient of determination is the square of the correlation coefficient, r, of the paired data $(y_i, \hat{y}_i)$, and represents the proportion of the variability in Y explained by the variability in the independent variables :

$$r^2 = 1 - \frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2}{\sum_{i=1}^{n} (y_i - \bar{y})^2} \tag{8}$$

Further details on the theory and implementation of multivariate regression models can be found in Johnson and Leone (1964), McClave and Dietrich (1979), and Flury and Riedwyl (1988).

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19. ABSTRACT

The gap in realism between a simulator for training and actual combat conditions is an issue requiring further attention. This preliminary study is the first part of a long term investigation aimed at developing quantitative methods for evaluating the effect of fear on combat performance. The relationship between subjective ratings of fear and the appearance and perception of threat were investigated using psychophysical experiments. It was found that fear was more strongly correlated with the perception of threat rather than the actual appearance of the threatening object. Data were used from experiments comparing observer ratings of a variety of animals known to evoke emotional responses in humans.

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