

## HEART RATE AS A MEASURE OF READING INVOLVEMENT

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### SUMMARY

Using telemetry, heart rates were measured on 20 male seventh graders during the reading of two selections, a science fiction story and a selection from a history book. Heart rates during the science fiction selection were significantly lower than during the historical selection. Further, the mean heart rates changed significantly during different parts of each story.

### INTRODUCTION

In a recent monograph, Squire (1964) addressed several basic questions to researchers of response to literature: "What happens to readers while they read and respond to literature? What do they think, feel, or react to at any moment? (p. 3)" Researchers have traditionally sought answers to these questions in terms of verbal reactions to the written word. Squire observed, for example, that "Studies of response to literature have dealt with reactions obtained at the end of reading-- after a story or poem is completed (p. 3)." He cited the work of such literary critics as I. A. Richards, Louise Rosenblatt, and Thomas Clark Pollack as representative of "careful consideration" given to "the response of readers" after the reading of a literary piece. Squire's own research represented an approach which sought to examine verbal responses during the reading of four short stories.

Certainly, responses to literature may take other than verbal forms. The scope of response to literature is well expressed by Purves (1968) who states that "response to literature is mental, emotional, intellectual, sensory, physical. It encompasses the cognitive, affective, perceptual, and psychomotor activities that the reader of a poem, a story, or a novel performs as he reads or after he has read (p. xiii)."

Researchers in response to literature however, seem to focus on overt verbal responses to literature, ignoring, in effect, covert physical response. Noting that "little has been done" in the area of "other physical aspects of response," Purves (1972) cites only four studies aimed at "direct physical response" to literature:

Peddie studied the responses of secondary students with marked haptic tendencies . . . . Strother found a relation between muscle activity and types of poems read aloud . . . . Nikifuravna made one of the few studies of inner speech and literature . . . . Kaiser investigated the relation between metaphor and galvanic skin responses (pp. 24-30).

Establishing physiological correlates to generally accepted psychologically-based, but empirically unproved, pedagogic assumptions in the teaching of English can serve to broaden the empirical base from which a sound pedagogy can grow. For example, from our experiences with literature, we are reasonably certain that a phenomenon described by Squire (1964) as "self-involvement" occurs in the reading of a piece of literature. Verbal evidence of a reader's self-involvement in John Knowles' A Separate Peace might be found in such reactions as "I felt like I was right with Phineas" or "Phineas was such a beautiful person that I choked up when he died." To be sure, a wide range of involvement with a literary work is possible. In discussing the results of his study as they relate to self-involvement, Squire (1964) indicated that involvement level changes as the story develops.

The statements coded under self-involvement indicate varying degrees of identification and rejection; not until after the exposition of a story is read and considered do the percentages of responses indicating emotional involvement tend to increase . . . . Many of the evaluations of the story as literature occur either before the reader has become involved or after an extended period during which the subject seems considerably involved in the central experience or the character whom he is interpreting or identifying with or rejecting (p. 31).

One level of involvement may be characterized by a reaction to literature which indicates perception of plot, characters, and other elements of the story as the dominant response mode, with very few responses reflecting other modes as interpretation or identification with the world of the story. A deeper level of involvement may be required if the reader is to participate in a more aesthetic or meaningful experience. In order to determine these various levels of involvement accurately, one must have access to the total responsiveness of the subject rather than merely those responses which are readily apparent.

The measure of covert physiological response provides another method for assessing the involvement level of students during reading. Certain bodily responses, such as heart-beat rate, have been shown to be correlated with various mental and emotional states. Typically, a decrease in heart-beat rate is related to an increase in the level of involvement when the stimulus is attention-provoking rather than emotion-loaded (Lewis and Wilson, 1970).

If it could be demonstrated that readers' heart-beat rates decrease after the exposition and reach their lowest points when the subjects are "considerably involved in the central experience," then we would have physiological evidence supporting Squire's finding that responses indicating involvement tend to increase after the exposition of a story is read and considered.

Presumably, literary material of a type which is preferred by the reader would generate greater self-involvement than material which is less preferred. Leafé (Purves, 1972) in a study of the content preferences of junior-high school students, found that seventh and eighth-grade boys preferred science-fiction stories to other types of reading material, including history. One might predict, therefore, that such students would become more involved when reading a science-fiction story than an historical account, and that their involvement would be reflected by a lower heart rate.

Thus, the purposes of the present research were (1) to determine whether two types of literary material differ in their ability to evoke reader involvement as measured by decelerated heart rate; and (2) to determine whether the preferred material will produce a greater decrease in heart rate response (greater involvement) to the reading of its central passage than to that of the less preferred material.

#### PROCEDURE

The subjects for this study were 20 male students enrolled in the seventh grade of the University School at Florida State University.

Upon reporting for the experiment, the subjects were fitted with a miniature heart rate telemetry device and were escorted to a private reading room. After being seated at a study table, they were asked to relax and rest comfortably for a period of five minutes. Then, when instructed to do so, subjects turned over the reading material which had been placed face down before them and began reading.

After subjects had completed the first reading, a second selection was placed before them. They were again asked to rest before turning over the material and beginning to read the second selection. Upon completing the second reading, the telemetry equipment was removed and subjects were asked to discuss their reactions to the reading material with the experimenter.

### READING PRESENTATION

The two reading selections were counterbalanced across subjects. The order of presentation of the two selections was randomly assigned for each subject with half of the subjects reading the selections in one order and the other half reading them in the inverse order.

The reading materials were of approximately equal difficulty and length. One of the selections was written by the investigators in order to create a high-interest story which conformed to the observations made by Leafé that science fiction and mystery most appeal to 7th and 8th-grade boys. The stimulus was prepared in three pages so that page one was essentially the exposition, page two contained the climax or central experience, and page three was primarily resolution.

The other selection was taken from a history textbook in an attempt to provide a reading material of lower interest than the short story to 7th-grade boys. Informal evaluation by seventh graders other than those in the study substantiated this choice. The history reading was divided into three pages; page one, the introduction, page two, the highlight of the piece (Greek and Roman governments); and page three, the conclusion. There was a conscious attempt to parallel the fictional "exposition-central experience-resolution" to the nonfictional (history) "introduction-highlight (major issue)-conclusion" by the page divisions.

### HEART RATE MEASUREMENT

The physiological telemetry system employed in this study consisted of two surface electrodes, a miniature FM transmitter, an FM receiver, and a polygraph recorder. The heart signals were transmitted from the classroom to the laboratory where they were recorded and analyzed. The telemetry system permitted the experiment to be conducted in a natural classroom setting.

Heart rates were measured using the peak method (unsmoothed) described by Opton, Rankin, and Lazarus (1965). Using this method, the highest heart rate reached during each 12-second period of reading was quantified. These segmental rates were averaged for the last minute of each rest period and for each page of the readings.

## RESULTS AND DISCUSSION

Post experimental interviews revealed that, in every instance, the subjects preferred the science-fiction story to the historical account. Thus, student preference for the reading material used in this study were consistent with those found by Leafe.

Table 1 shows the mean peak heart rate for each page and for each selection. The same information is depicted graphically in Figure 1. As predicted, heart rates during the silent reading of the science-fiction story were significantly lower (.01) than during the historical account ( $t=6.18$ ,  $df=19$ ). This finding seems to lend support to the notion that preference for a type of literature is related to the involvement which the reader experiences.

TABLE 1  
Mean Heart Rates During Reading of Each  
Page of the Two Selections\*

	Page 1	Page 2	Page 3	Total Selection
Fiction	88	86	83	86
Historical Narrative	94	95	90	94

\* More complete data on all subjects may be obtained from Dr. Michael Angelotti, The Developmental Research School, West Call Street, Florida State University, Tallahassee, Florida 32306

In both selections, a deceleration occurred during the reading of page one (exposition/introduction). However, the decrease was not as great during the history reading as during the reading of science-fiction. Furthermore, while reading the central experience or highlight of the selection (p. 2), subjects displayed an increase in heart rate for the history selection and a continual decrease for the science-fiction. The change in mean heart rate levels from page one to page two was significantly different at the .01 level ( $t=3.54$ ,  $df=19$ ) for the two stories. This finding suggests that the degree of involvement is differentially affected by the specific segments of the story.

Autonomic activity seems to reflect the degree to which each type of material engages the reader. Clearly, the historical material generated less involvement during the introduction than did the science-fiction story during the exposition. The highlight of the former appeared to have a lesser impact upon the reader than the central experience of the latter.

Covert physiological responses are extremely difficult to interpret out of context. Although the magnitude of these responses may be measured directly, the psychological state indicated by such responses must be inferred from other measures. These measures include verbal response to literature, scores on standardized psychological scales, and other factors such as the content of the reading material and the context in which it is presented (i. e., reading for information or reading for pleasure).

Earlier in this report it has been suggested that, typically, a decrease in heart rate is related to an increase in the level of involvement when the stimulus is attention-provoking rather than emotion-loaded. Conversely, when emotion-arousing portions of a literary work are presented, a reader would be expected to display an increase in covert arousal. These findings underscore the importance of contextual influence on the nature of the physiological response and suggest that physiological responsivity may be sensitive to various aspects of a literary work. Although in this study, the context was selected to produce an attention response, other investigators might develop literary contexts which attempt to elicit emotional reactions.

#### CONCLUSIONS

Additional research is needed to further examine the relationship between heart rate and involvement, and to investigate the interplay existing between heart rate and other types of verbal response such as interpretation, perception, and evaluation. Furthermore, other physiological responses such as brain waves and galvanic skin response can be studied to determine their relationships to the reading of literature and to the varieties of verbal response to literature. Generalizing

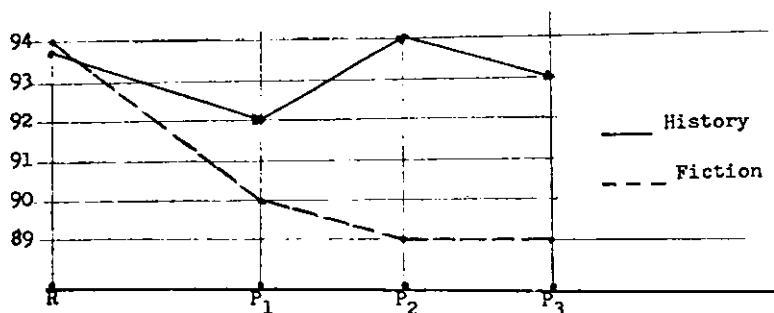


FIGURE 1. Mean Heart Rate for all subjects during last minute of Rest (R), Reading of Page one (P<sub>1</sub>), Reading of Page two (P<sub>2</sub>), and Reading of Page three (P<sub>3</sub>).

the definition of literature to include the total range of print and non-print media would greatly expand the potential for experimentation in psychophysiological response.

Considering physiological and psychological variables as they influence the transaction between reader and work, investigators could begin to establish a series of psychophysiological tests based on known interactions between verbal and physiological response. The results of such tests could be compared to typical patterns of response for sets of variables (i. e., grade, intelligence, sex, socioeconomic background) from which the success of materials, methods, and performance could be predicted or reasons for the nature of reading performance for particular students diagnosed.

Broadening the study of response to literature to include physiological as well as verbal measures, can contribute to the empirical validation of psychological constructs relating to literature education. Hopefully, this approach will generate a body of knowledge which will be of practical use in determining classroom practices. Ultimately, the product of psychophysiological approach to research in response to literature should result in a more comprehensive picture of the reader and the reading process.

#### REFERENCES

- Lewis, M. and Wilson, D. The cardiac response to a perceptual cognitive task in the young child. Psychophysiology, 1970, 6, 411-420.
- Opton, E. Jr., Rankin, N. O., and Lazarus, R. S. A simplified method of heart rate measurement. Psychophysiology, 1965, 2, 87-97.
- Purves, A. C. and Pippere, V. NCTE research report No. 9. Champaign, Ill.: National Council of Teachers of English, 1968.
- Purves, A. C. Studies in response to literature. Research in response to literature and the teaching of literature. Final report, January 3, 1972, Project Number H69-0129, National Endowment for the Humanities.
- Squire, J. R. NCTE research report No. 2. Champaign, Ill.: National Council of Teachers of English, 1964.