NOTES

The phono cartridge fidgetometer: Methodological considerations

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In many applications, the investigator views movement as activity that contaminates (Crider, Shapiro, & Tursky, 1966) or requires separate assessment (Rice, 1966) of concomitantly observed physiological data. Other researchers are interested in measuring movement for its own sake (e.g., Cromwell, Baumeister, & Hawkins, 1963).

The present note concerns methodological aspects of a slight modification of the system described by Crider et al. (1966) for recording movement. Their system consisted of "a crystal phonograph cartridge whose stylus was replaced by a 3-in. section of piano wire terminating in a lead weight. It was fixed to the springs of the subject's chair . . . amplified and quantified by means of a voltage comparator" (p. 21). The modifications, dictated primarily by convenience, involved the equidistant attachment of two ceramic cartridges¹ to the springs of seat. Another cartridge was taped to the upholstery material under the back of the chair, so that the transducer paralleled the subject's spine. In addition, 20-cm lengths of phosphor bronze, rather than piano wire were employed, and lead weights were omitted. Figure 1 displays the transducers after attachment to the springs of the chair. The cartridges were connected in parallel and amplified with direct coupling by a Beckman Type R dynograph with upper frequency cutoff of 30 Hz. Because the purpose of the fidgetometer is to detect gross activity regardless of its locus in the chair, no attempt was made at separate amplification of the cartridges. If an investigator's application requires fine localization of movement, electromyographic measures are indicated. However, that technique may require several polygraph channels, which may be silent for a considerable portion of a record.

Figure 2 displays two sections of the record of a college student's electrocardiogram and activity level (upper and lower traces, respectively). Parts of both segments, especially the upper trace, illustrate vigorous movement. In addition, these examples exemplify several characteristics of this fidgetometer that are

especially relevant to its use with integrators. For instance, the records are characterized by rhythmic low-frequency oscillations that emerge only when a subject is seated in the chair, thereby ruling out artifacts due to effects of air-conditioning on the wires. A high-pass filter with a time constant of about 1 sec seems appropriate for suppressing these components of the signal. In addition, recording at a gain necessary to observe movement results in fairly constant background activity that peaks almost coincidently with the T wave of the electrocardiogram. Lacey and Lacey (1974) have noted that systems of this type may detect the ballistocardiogram. This point is important, because the magnitude of the signal varies across subjects and, sometimes, within the same subject over a session's recording. Compare the pulse marked by an arrow in the lower movement record with the rest of the trace. This wave exemplifies phasic changes in pulse amplitude within a session. In addition, long-lasting changes in absolute

Figure 1. Bottom of the reclining chair. Two transducers were mounted on the springs of the chair. Masking tape, normally used for fastening the cartridges to their position, was removed for clarity of the photograph. "Hot" and "ground" leads from each cartridge are connected to the corresponding leads from the other transducers. The third cartridge, which is mounted on the back of the chair, is not shown in this figure.

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Figure 2. Two segments from a college subject's record. In each case, the upper trace is the electrocardiogram and the lower one gross activity level. Both signals are displayed with curvilinear tracing. The calibration marks represent 2 mV and 1 sec. The arrow on the lower movement trace points to an unusually high pulse, which seems to reflect a ballistocardiographic phenomenon. Note the vigorous movement depicted on the upper movement trace.

amplitude of the background activity may also occur. As a result, part of this signal includes a variable portion that is not movement and cannot be readily identified from an integrated record. It is also apparent from the figure that this signal is not always symmetrical around the isoelectric line. Thus, incomplete or misleading results may be obtained with integrators that rectify only half of the signal.

These observations on the phono cartridge fidgetometer are representative of over 80 different records from my laboratory and apply to two different reclining chairs. Neither of these chairs rocked or displayed motion of any type. Of course, some differences may be obtained across laboratories because of the transducers employed, their sites of application, and idiosyncracies of the chair. In all instances, important sources of variance that are very difficult to control include the relative position of the subject, (i.e., supine or sitting up) changes in posture, and relative weight and stature.

Another aspect of this measure relates to the method of quantification proposed by Obrist, Howard, Sutterer, Hennis and Murrell (1973). With the Obrist et al. technique, an epoch of several seconds is spanned, e.g., a reaction time (RT) foreperiod. For each second, the percentage of trials is computed on that movement

which exceeded a minimum level. It is not uncommon to obtain zero scores, i.e., no movement. This condition may result in proportional means and variances, so that the square root $\sqrt{x+1}$ transformation is required before application of parametric tests (Winer, 1972).² In all probability this condition is attenuated if the number of trials is increased. In a recent study (Klorman, 1975), reliable slow EEG and cardiac RT curves developed over blocks of 15 trials. Even with blocking over 45 trials, the average percentage of trials on which 12 college subjects moved in the second prior to the warning signal is 3.34%. Although the experimental instructions promoted somatic quiescence, comparable data (10%) have been reported by Obrist et al. (1973). Thus, in the typical situation, large numbers of trials and the square root transformation may be indicated.

The methodological considerations outlined in this paper do not militate against the judicious use of the phono cartridge fidgetometer. This method of recording movement is far more convenient than multiple electromyographic channels if only gross indications of somatic activity are required.

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- eous electrodermal activity. *Journal of Comparative and Physiological Psychology*, 1966, 61, 20-27.
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NOTES

1. The cartridges were taken from E-V Game Stereo Deluxe tone arms No. STE-35. The two "ground" and "hot" leads were shorted with each other. Comparable signals and results are obtained from monophonic transducers). The supplier is E-V Game, Inc., Freeport, New York 11520.
2. I am indebted to Michael Davidson for suggesting this transformation.

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