TECHNICAL NOTE

A UNIVERSAL BEHAVIOR GRAPH PAPER¹

In any setting where behavior is recorded, a great deal of time is expended in the manual tasks of creating linear graphs with the appropriate features. The resulting graphs differ widely in appearance and may lower accuracy of recording and complicate interpretation. The semi-log chart paper of Lindsley (1968) represents an attempt to deal with this situation.

A solution to these problems would be the development of a standardized universal behavior graph with the following features: (1) it must allow for a variety of labels on the ordinate, (2) it must have the capacity for a wide range of numbers on the ordinate, (3) it must include a wide variety of units of time on the abscissa, (4) it must include space for basic information about the circumstances of the behavior recorded, and (5) it must be simple and quick to use. A universal behavior graph meeting these qualifications is shown in Fig. 1.

This is a linear graph with 100 units (16 to the in.) on both axes. Medium-weight lines mark the units in multiples of five and heavy-weight lines denote 10 units, thus facilitating quick and accurate reading.

The top horizontal line is labelled calendar weeks, and Sundays are numbered through 14 weeks.

The abscissa is labelled in such a manner that most units of time can be easily chosen. These include consecutive, daily, or intermittent minutes, hours, days, or sessions. The appropriate label is designated by filling in or blackening between the dotted lines, as on a machine-scored test answer sheet. The four blank spaces divided by a decimal point are for designating the unit of a single lightweight line on the graph and must be filled in appropriately. For instance, if an experimenter were recording a subject's rate of responding during a daily 2-hr experimental session, the abscissa would be notated as daily 2.0-hr sessions. If a teacher were recording a child's rate of behavior during different periods of the day, the abscissa would read intermittent 1.0-hr sessions (each light-weight line referring to a single session, the sessions being recorded with a variable frequency on any one day). If the graph were being used cumulatively, the abscissa might read consecutive 10.00 min. This would mean that each line adds 10 min to the previous one, so line 20 would indicate 200 min. A therapist recording his patient's behavior on variable days of the week could look at the data across the seven days of the week (daily) or independently of the weekdays (intermittently), in which

case the data points would be plotted on successive lines. It can be seen that this form of labelling for the abscissa allows for a wide variety of specific choices while retaining a simplicity in notation and interpretation.

The ordinate utilizes the same basic format of notation as the abscissa. By blackening between the lines (connecting the words), one can label the axis rate, percentage, or number; or cumulative rate, percentage, or number.

When plotting data cumulatively, the data line may reset as an automatic cumulative recorder does. The line may be reset after the top line is reached, each reset designating the maximum number of responses possible with the multiplicative and/or additive factor(s) used. This number is always a multiple of 10, thus facilitating reading of the data. The data line may also be reset upon reaching other fixed cumulative totals, or it may be reset on a time basis, such as weekly.

The range of numbers assigned to the ordinate may be widely varied by using a multiplicative and/or additive factor. By placing a decimal point in the appropriate position in the multiplicative factor, the range on the ordinate may include numbers from 0.001 to 0.01 or from 1000 to 10,000. Thus, use of this multiplier simply means that each number (or position) on the ordinate is multiplied by the appropriate factor of 10. The additive factor operates in the same manner. For instance, if data points were being recorded that typically varied between 1700 and 1800, the correct notation would be $\times 00100.0 + 001000$.

However, if the data usually varied between 90 and 110 responses, using the left-hand ordinate the multiplier would have to be 00100.0, which would place the data points low on the graph and within a very narrow range. The solution to this and similar problems is to use the right-hand ordinate, where the data would be centered on the graph over a larger range. The labels and the multiplicative and the additive factors apply to whichever ordinate is being used, and this choice is indicated by blackening the appropriate dotted arrow at the bottom of that axis. An even greater degree of flexibility might be obtained by designing the graph without numerical values on the right-hand ordinate (and even the abscissa); however, this would also detract from the standardized appearance of the graph paper.

Information identifying the graph may be recorded on the right-hand side. This way of displaying identifying information is particularly easy to read. Figure 1 uses terminology appropriate to an experimental situa-

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tion (sub-human or human). Of course, a variety of labels may be used for these blanks depending on the setting. In a school system, they might be Behavior, Student, Code, Teacher, Class, and School. In a hospital or clinic it could read Response, Patient, Code (or Number), Therapist, Ward, and Institution. The blank space beneath the last label may be used for notes, contingency arrangements, schedules of reinforcement, etc.

Copies of this Universal Graph Paper may be obtained by having a double-sized art copy drawn on heavy white posterboard. The camera-ready art copy can then be photographed, reduced, and copies may be offset printed at a very reasonable cost per 500 sheets.²

REFERENCES

Lindsley, O. R. Advertisement. *Journal of Applied Behavior Analysis*, 1968, 1, inside back cover.

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²An 8 by 10 black and white glossy print of the graph ready for offset printing may be obtained from the author at Georgia State University, 33 Gilmer Street, Atlanta, Georgia 30303, for \$.50 to cover costs.