40-cm length of copper wire, 0.3 mm in diameter) is attached at one end to a screw that serves for readjustment of the sonometer in case it gets "out of tune," then passes over two bridges, B_1 and B_2, made of glass rods; at the other end it is attached to an expansion spring R, which may be stretched by turning the knob K of a wooden pulley. The spring should be able to carry a load of 1 kg. A pointer P is attached to the movable end of the spring over a scale D. The latter is calibrated in terms of the tension in 100-g units by means of weights varying between 50 and 1000 g.

When the tension is so adjusted that the natural period of the wire is the same as that of the alternating current, the wire begins to vibrate. The frequency of vibration f of the sonometer wire is expressed in terms of cycles per second. Thus,

$$f = \frac{1}{2L}\sqrt{\frac{T}{m}},$$

where T is the tension in the wire in dynes, L is the length of the wire, and m is its mass-per-unit length. If a tuning fork of known frequency is used to measure f, then L, m, and an instrument constant c may all be incorporated in one constant k. Hence, $f = k\sqrt{T}$.

In order to calibrate the instrument, k is first determined as follows. The tension in the wire is adjusted until it resonates with the vibrating tuning fork (of frequency f) whose base is held on the wooden framework of the sonometer. The value for T is indicated by the pointer P, the scale having been calibrated previously with weights. The known values are then substituted in the equation.

When the speed of rotation is measured, the tension in the sonometer wire is varied until the wire vibrates with maximum amplitude. Owing to the small intensity of the current coming out of the amplifier, the wire vibrates only at the natural frequency of the current. It is possible to measure speeds higher than those registered on the scale since the harmonics of the vibrating wire can be obtained by varying the tension. In such cases the frequency reading on the scale should be multiplied by the number of internodes observed.

The accuracy of the instrument was tested stroboscopically, and the deviation between the two methods was found to be about 1 percent. This error is greater than that of more complex instruments described in the literature (*2*), but the sonometer described has the advantage of simplicity and may be constructed with ease in any laboratory.

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8 February 1955.

Uncritical Citation of Criticized Data

In an earlier communication, Zirkle (*1*) discussed the citation of fraudulent data, particularly the refuted work of Paul Kammerer, the Viennese zoologist who claimed to have proved that acquired characteristics are inherited. Zirkle pointed out that reports of Kammerer's work are beginning to creep back into current literature, and that, either knowingly or unknowingly, some of those who cite his findings have failed to mention the damning criticisms.

Zirkle's note suggested to us somewhat analogous situations in the field of psychology. Therefore, we attempted to determine whether two much disputed studies (fraud was not alleged for one or definitely proved for the other) relating to the stability of the IQ are being quoted in current psychological textbooks without criticism.

In 1938 a group of experimenters at the University of Iowa published a monograph (*2*) that showed large increases in the IQ's of a group of preschool orphans who were given the opportunity to attend nursery schools. Beth L. Wellman popularized their findings by writing reports for several periodicals (*3*). The "Iowa studies of raising the IQ" were subsequently criticized, primarily for erroneous statistical procedures employed, by Simpson (*4*), Goodenough and Maurer (*5*), and McNemar (*6*). Although Wellman attempted to refute these criticisms (*7*), many psychologists found her defense unconvincing.

Similarly, in 1946 there appeared in *Psychological Monographs* (accompanied by an editorial note with regard to its controversial nature) a study by Bernardine G. Schmidt (*8*) that reported phenomenal increases in the IQ's of children originally classified as feeble-minded. She popularized her conclusions in several journals (*9*) and became the object of much publicity (*10*). Then Kirk played detective and unearthed many aspects of Schmidt's work that seemed to invalidate her most important claims (*11*). When Goodenough (*12*) later reviewed Schmidt's monograph, her remarks were for the most part quite critical. Nolan (*13*) published a rather informal survey of opinions of several leading psychologists who had attempted studies similar to Schmidt's concerning the validity of her findings. The general consensus was that her investigation had many crucial flaws.

In searching through 21 textbooks in child, educational, and general psychology, all published not earlier than 1949, we found a number of references to the controversial studies of Wellman and Schmidt. Approximately one-half of the books did not mention either of the investigations, and it was gratifying to find that 73 percent of the writers who did refer to them also included criticisms. However, three educational psychology textbooks (*14*) cited the Iowa studies as evidence of the instability of the IQ, but did not criticize them. All writers who referred to Schmidt's study also made critical remarks concerning it.

The uncritical citation of disputed data by a writer, whether it be deliberate or not, is a serious matter. Of course, knowingly propagandizing unsubstantiated claims is particularly abhorrent, but just as many naive students may be swayed by unfounded assertions presented by a writer who is unaware of the criticisms. Buried in scholarly journals, critical notes are increasingly likely to be overlooked with the passage of time, while the studies to which they pertain, having been reported more widely, are apt to be rediscovered.

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3 February 1955.

Natural Dams of Havasu Canyon, Supai, Arizona

Inaccessible except on foot or on horseback, Havasu Canyon is a deep-sided canyon in the southwestern part of Grand Canyon National Park. It is reached only by steep winding trails.

Emerging from the Supai formation, some 2700 ft below the rim of the Grand Canyon, are a series of fresh-water springs whose overflows join and flow down through Havasu Canyon. This creek, bearing the same name as the canyon, once had beautiful blue-green water. Hence, the Indians living there are called the *Havasupais,* which, translated, means "the blue-green water people."

In addition to its phenomenally colored water, Havasu Creek deposits spectacular mineral dams across parts of its course north of the Supai village (Fig. 1). These dams sometimes build upward as much as 2 ft a year. The local Indians give little thought to this until the water levels at the fords become so deep

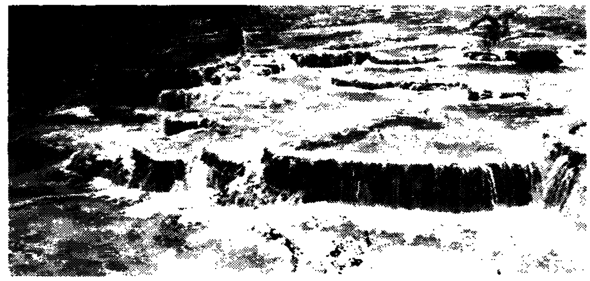

Fig. 1. Natural dams near the base of Havasu Falls.

that their feet get wet when they are crossing them on horseback. When this annoying height is reached, the dams are breached with explosives until the water levels return to a convenient fording height.

Although they readily encrust any submerged twig or root (Fig. 2), the minerals never seem to impregnate porous, dead bits of wood. Other than arching downstream, there is little consistency in the method of mineral deposition or in the structure of the dams. Anything resisting the flow of the creek tends to become encrusted with minerals and to initiate a dam. Analyses of mineral samples indicate that the subaqueous deposits are primarily calcite with some admixed clay. Remnants of older and higher deposits of minerals now visible along the lateral areas of Havasu Canyon contain layers of crystalline calcite, aragonite, and clay, as well as manganese oxide stains, on their weathered surfaces. Both old and recent deposits are rich sources of impressions of past and present vegetation in this region.

Water spray from the base of Havasu Falls drifts and covers the nearby trees. Evaporation of the moisture causes minerals to deposit as layers toward the direction from which the spray comes. Even living trees may have their twigs so heavily covered with mineral residues that their buds have difficulty emerging from any side but the one opposite the layers of minerals. These residues contain mostly aragonite, some calcite, and included clays.

A flash flood rampaged through Havasu Canyon in August 1954. Tumbling debris destroyed many of the mineral dams and altered the crests and spillways of

Fig. 2. Inside an old natural dam showing the nature of mineral deposits on twigs and branches.