

of male slides (male standard VCS); and (e) sexual orientation, which will be measured by a self-report questionnaire before and after treatment.

A two factor repeated measures analysis of variance will be conducted on three of the dependent measures (a) rating of male therapy VCS; (b) rating of female therapy VCS; and (c) sexual orientation scores. A non-parametric test, the Mann-Whitney U test will be used to determine significance between experimental groups on the plethysmographic measures. Separate treatment mean scores for rating of male and female therapy VCS will be done using a t test.

Plethysmograph As a Measure of Male Sexual Arousal

The plethysmograph as a measure of male sexual responsiveness will be examined because of the importance of this measure in substantiating treatment effect.

The use of physiological measures in the treatment of male homosexuality is highly recommendable in assessing treatment outcome (Bancroft, 1971; Freund, Sedlacek & Knob, 1965). The empirical value of using only subjective measures is questionable (Birk, et al., 1972). A primary criticism of Feldman and MacCulloch's research is that their outcome measures were subjective in nature (MacDonough, 1972).

Sexual arousal is not a unitary state and so by definition measurement cannot be restricted to subjective measures. Callahan

and Leitenberg (1973) caution, however, that "penile erection is not a reflexive response which allows the therapist an automatic laboratory analogue of a person's sexual behavior in his natural environment" (p. 72). The implication from the Callahan and Leitenberg statement is that a physiological measure alone is not sufficient and that other valid and reliable measures should be used in determining therapeutic change.

A major criterion in determining degree of change from homosexual to heterosexual is the intensity of sexual arousal elicited from male and female sexually oriented stimuli (Bancroft, 1971). In his extensive review of measurement of male sexual arousal, Zuckerman (1971) stipulates that penile erection is the most reliable and objective method of measuring sexual arousal in the male. Bancroft (1973) concurs with Zuckerman, "penile erection is a physiological response to sexual stimulation and more important it is likely to be interpreted as such by the subject."

An appropriate plethysmographic apparatus to accurately measure penile arousal under experimental conditions was not developed until the mid 1960's. Currently there are several types of plethysmographic monitoring devices being used in research. Jovanic (1971) reviewed three major types of plethysmographs being used: (a) the volumetric plethysmograph (Freund, Sedlacek & Knob, 1965), (b) the mercury in rubber strain gauges (Bancroft, Jones & Pullan,

1966; Fisher, Gross & Zuch, 1965; Karacan, 1969), and (c) the metal ring strain gauges (Barlow, Becker, Leitenberg & Agras, 1970; Johnson & Kitching, 1968).

The use of plethysmographic monitoring of penile erection was first described and demonstrated by Freund et al. (1965). Their volumetric plethysmograph measures the increase of the total volume of the penis. In his review, Zuckerman (1971) describes the Freund et al. apparatus:

Penis is inserted through a flat, soft sponge-rubber ring and an electric rubber tube made from a condom and into a glass cylinder. The cylinder tapers down at the end of a narrow funnel which connects by tube to the volumetric instrument. A sponge-rubber ring which acts as a pad for the cylinder is fitted on the penis. A glass cylinder is attached to the body with straps. An elastic cuff is inflated with air to fill up the broad end of the cylinder to make its base airtight. Supply of air to cuff is shut off and the funnel of the cylinder is connected by tube to the volumetric device (p. 310).

McConaghy (1967) developed a penile plethysmograph similar to Freund et al.'s (1965) device. The penis is inserted through the open end of a finger stall which maintains an airtight container. The cut end of the finger stall is stretched over a cylindrical tin. A nipple is attached to the closed end of the cylinder and connected by a plastic tube to a Grass pressure transducer. McConaghy first used his plethysmograph to measure the erotic reaction of 22 homosexual referrals and 11 heterosexual medical students. The device was successful in differentiating between the homosexuals and heterosexuals. The homosexuals showed a greater

response to nude males than to females as compared to the medical students.

Bancroft et al. (1966) developed a transducer that was simpler in design to the Freund model and easier to use. As opposed to Freund et al.'s volumetric device, Bancroft's mercury-in-rubber strain gauge measures change in circumference of the shaft of the penis at one point only. The following is Bancroft's (1974) description of the device:

Approximately 6 in. of clean silicone rubber tubing of internal diameter 0.025 in. is filled in the following way. Clean mercury is injected into the tube using a syringe and hypodermic needle. Care is taken to ensure that there are no breaks or air bubbles in the mercury column. The open end of the filled tube is then closed with one stainless steel electrode which is simply threaded into the tubing. The other end is then cut just below the hypodermic needle ensuring that the tube remains filled with mercury. The second electrode is then threaded into that end of the tube. The tube and electrode can then be fitted into the perspex carriage and connected via the leads to the Wheatstone bridge circuit and amplifier. The strain gauge is highly sensitive to resistance change, hence electrical contacts must be sound and highly flexible leads should be used. The fracture of just a few strands in a multi-strand lead can cause intermittent contact and render the strain gauge useless (1974, p. 229).

The strain gauge is fitted by the subject around the penis and worn under his clothes. Measurement is determined by change in penile circumference which is registered on a 50 microammeter as changes in current. A change of 2 microampers is equivalent to an alteration of 63 millimeters in the circumference of the penis. The

authors reported that the average increase for a complete erection was 25 millimeters.

Barlow et al. (1970) developed a metal ring gauge similar to Bancroft's device. Barlow et al. maintains that their apparatus is more accurate than Bancroft's because rubber surgical tubing was not used. In the Bancroft strain gauge, the surgical tubing tended to separate at the upper range of volume displacement and therefore interfere with accurate measurement. Barlow et al. also criticized Bancroft et al.'s device in terms of its temperature sensitivity and the fact that they are difficult to build.

A primary advantage of Barlow et al.'s device is that its design is relatively simple. It consists of a strain gauge encompassed in a ring of plastic. The penis is fitted through the ring, which was not reported as constricting or uncomfortable. Measurement of penile volume changes was recorded on Grass Pre-amplifier. The authors reported that the recordings from the penile ring were said to be linear with the volume change within a range of 25-40 mm.

In testing the device, Barlow et al. found the chief disadvantage of their apparatus related to the fact that volume displacement could take as long as five minutes to return to the original baseline. If the level showed a greater displacement it was necessary to re-set the baseline. This could prove annoying to the participant and perhaps interfere with accurate feedback.

The choice of which pleythysmographic measure to employ in treatment or research depends on several factors (Bancroft, 1974; Zuckerman, 1972). Accuracy of measurement is the primary consideration. Freund et al. and McConaghy rely on relative measures and consequently measurement on a known scale is not possible. In contrast, the Bancroft and Barlow devices are easily calibrated with a near linear relationship between penile circumference and change in current. This latter measurement advantage facilitates ease and accuracy of data collection.

A second criterion that must be considered is probability of movement artifact. Freund et al. reported that a movement artifact was detectable and therefore a potential problem at rapid oscillations. Because of its design, the Bancroft strain gauge is less vulnerable to movement artifact. There was nothing reported by Barlow et al. regarding a movement artifact.

Ease of implimentation is a third criterion in choosing an appropriate apparatus. Bancroft et al.'s device is easily fitted by the subject and is worn under his clothes. A major criticism of Freund's apparatus is that it is cumbersome and difficult to use (Bancroft, 1973). Another criticism of Freund et al.'s device which is more pertinent to research is that the design of the apparatus can cause initial arousal unprovoked by experimental stimuli (Zuckerman,

1971). Requiring a subject to insert his penis into an unfamiliar device could also be anxiety producing.

Bancroft's strain gauge was selected for the present investigation because of (a) measurement accuracy, (b) ease in finding materials, (c) building the apparatus, and (d) minimal movement artifact and reliability expectations.