The first two points in each of the curves of Fig. 1a represent the performance of independent groups of animals tested after the original problem or after a single reversal. In each case, there were significantly more errors in the R_1 test than in the R_0 test ($P < .01$). Whatever its explanation, the discrepancy between the new results for the pigeon and the earlier ones reminds us that further work might show proactive interference in the goldfish as well. Only after seeking the effect without success under a wide range of conditions can we be confident that it does not occur. On the assumption that proactive interference produces progressive improvement, we feel, however, that those efforts will be unsuccessful, because the fish fails to show progressive improvement under a wide range of conditions.

Our results suggest that different memory mechanisms operate in pigeons and goldfish. When a color preference is established and reversed in a pigeon, traces of the original training apparently remain after reversal training to interfere with the traces of that training and of subsequent training. Ablation experiments suggest that the hyperstriatum of the pigeon plays a part in the storage of these traces (*7*). After the reversal performance of a pigeon has been improved by training in a series of problems, injury to the hyperstriatum produces better retention of a preference established after operation and makes reversal difficult once more. One way to explain the fish results is to assume that, when a preference is reversed in a fish, the effects of the original training are not stored independently after reversal, but supplanted entirely by those of the reversal training. The progressive improvement in habit reversal which appears in the fish after enlargement of the optic tectum by transplantation (*8*) may be due to enhanced capacity for storage and the consequent opportunity for interference.

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Family Size and Sex-Role Stereotypes

Abstract. *Social attitudes about sex roles have been implicated as important factors in population growth. Degree of incorporation of stereotypic sex roles into the self-concepts of mothers is found to be related to completed family size.*

Rising concern about world overpopulation has focused interest on factors that influence family size. Initial optimism about the efficacy of the rapidly developing birth control technology has now become tempered by recognition of the possibility that social and psychological attitudes affecting the acceptance of the available methods may set limits to effective population control. A number of social factors related to family size have been previously identified and discussed, for example, socioeconomic class, education, and religion (*1*).

Davis (*2*) and Blake (*2*) have proposed that a critical psychological factor affecting the number of children a woman both desires and achieves is her acceptance or rejection of the feminine stereotypic social role prevalent in our society. Blake (*2*) has argued that most societies hold "pronatalistic" attitudes which prescribe for women the role of child-bearer and rearer. Acceptance of alternative feminine roles, such as employment in the work force, could reduce the social and intrapsychic pressure on women to produce children, and thus result in a smaller achieved family size. Several studies have reported that working women do indeed desire and have smaller families than nonworking women (*1, 3*). However, to our knowledge, no data exist on relationships between completed family size and the self-concepts of women with respect to alternative sex roles. The present study reports the finding that women who hold relatively masculine self-concepts have significantly smaller completed families than women who hold more stereotypically feminine self-concepts.

Ninety-six Catholic mothers of male college students completed a sex-role stereotype questionnaire. The construction and use of this instrument have been described in detail elsewhere (*4*). Briefly, it consists of 122 traits chosen by college students as discriminating between men and women. For each trait there is a bipolar horizontal scale, labeled at intervals with numbers, from "1" on the left to "7" on the right, with nine points between any two numbers. (On one such scale, for example, "1" would mean "not at all aggressive" and "7" would mean "very aggressive.") The responder can place a mark anywhere on the scale, under a variety of instructional conditions.

Each mother filled out the form three times: once as descriptive of adult men (masculinity response), once as descriptive of adult women (femininity response), and finally as descriptive of herself. Approximately half the mothers received "male" instructions first, while half received the "female" instructions first; "self" instructions were always given last so that the self ratings were always made within a masculinity-femininity context.

The male and female poles of each questionnaire item were defined by majority opinion of the mothers. Those items on which the consensus exceeded the .001 level of probability (at least 68 percent agreement) were termed "stereotypic." Fifty-seven items met this criterion.

Social desirability ratings for each item were obtained from a previous study (*4*) where 48 male and 39 female college-age students were asked to indicate the extent to which each trait would be desirable for a mature, healthy adult, sex unspecified.

To facilitate the present data analysis, the scores of all items on which a low score was judged socially desirable were reflected about the mean such that a high score always indicated social desirability. Items where the male pole was more socially desirable were termed male-valued items, while items where the female pole was more socially desirable were termed female-valued items. Of the 57 stereotypic items, 45 were male-valued and 12 were female-valued. The positive poles of the male-valued stereotypic items describe a rational, competent, active, mature individual who is capable of functioning effectively in our society. These stereotypic items have been termed a "competency" cluster.

The positive poles of the stereotypic female-valued items, on the other hand, describe a gentle, sensitive, expressive individual. Hence, the female-valued stereotypic items have been termed a "warmth and expressiveness" cluster. The description of the typical adult male, then, involves high scores on the competency cluster and low scores on the warmth and expressiveness cluster, while the pattern of responses describing the typical female is the reverse.

Each mother's 366 item responses were converted to sigma scores (*5*) in order to eliminate any individual response biases which might have been present, for example, a tendency for a particular subject to use only one part of the scale.

Two self-concept scores were computed for each mother by summing and averaging the sigma scores of the "self" responses (i) to the male-valued stereotypic items, that is, the competency cluster, and (ii) to the female-valued stereotypic items, that is, the warmth and expressiveness cluster.

A variety of background information was also requested from the subjects; pertinent to this report are (i) the number of children that she has had, (ii) years of completed formal education, and (iii) the number of years worked subsequent to termination of formal education. Sixty mothers who were between 45 and 59 years old, who were living with their husbands, and who had two or more children were included in the remainder of the study. Women with only one child were excluded to eliminate possible early fertility problems, and younger women were excluded because their families might not yet be completed.

Subjects were divided into two groups based on a median split of the self-concept scores derived from the competency cluster. Mothers with above-median scores, that is, those who tend to incorporate more of the positively valued, masculine stereotypic traits into their self-concepts, were compared to mothers with below median scores, that is, women whose self-concepts include less of the positively valued male competency cluster. The two groups did not differ significantly in educational level or in the total number of years worked since the completion of formal schooling.

A $2 \times 2 \times 2$ analysis of variance for unequal group size (*6*) with number of children as the dependent variable was performed. The independent variables were: self-concept score on the competency cluster (above versus below the median); total number of years worked (8 or more years versus 7 or less years); and educational level (13 or more grades versus 12 or less grades).

Mothers with high competency self-concept scores were found to have significantly fewer children (mean = 3.12) than mothers who perceive themselves to be low on the competency cluster (mean = 3.93). The difference of 0.81 children is significant beyond the .025 level of probability ($F = 6.13$, d.f. 1/52).

Number of years worked was related to number of children in the expected direction, but did not reach statistical significance ($P < .10$). Women who worked for 8 or more years had a mean of 3.20 children, while women who worked 7 or less years had a mean of 3.80 children. This finding, although not significant at the .05 level of probability, replicates findings of earlier studies that extent of work is negatively related to number of children born.

The number of years worked appears most strongly related to family size in women who perceive themselves as having less of the behavioral traits comprising the competency cluster: women with low self-concepts who have worked 8 or more years average 3.30 children, while women with low self-concepts who have worked 7 years or less averaged 4.43 children. Number of years worked did not differentially relate to family size in women with above-median self-concepts. The mean family sizes of these latter groups are 3.12 children for 8 years or more work, versus 3.13 children for 7 years or less. This interaction does not quite reach the 5 percent level of confidence ($F = 3.10$, d.f. 1/52, $P < .10$).

Similar analyses performed with self-concept scores derived from the female-valued warmth-expressiveness cluster did not yield significant results.

The results indicate, then, that women who perceive themselves as possessing to a greater degree the socially desirable traits stereotypically associated with the masculine role have fewer children than women who perceive themselves as more stereotypically feminine on these traits.

Interpretation of these findings is not without ambiguity. It is not clear whether women perceiving themselves as relatively more competent chose to have fewer children, or whether a woman's estimation of her own competency diminishes under the stress of a larger family. A longitudinal study will be required to resolve this question. It would also be useful to examine these variables in a non-Catholic population.

The incorporation of male-valued stereotypic traits into the female self-concept should not be interpreted as a shift away from the positively valued characteristics of femininity. The correlation between the male-valued self-concept scores (competency cluster) and the female-valued self-concept scores (warmth and expressiveness) is low and not significant ($r = .158$, $P > .10$). Thus the self-concepts of the two groups differ only with respect to the negatively valued aspects of the feminine stereotype.

Although sex-role stereotypes assign greater competency to the masculine role and lesser competency to the feminine role, competency can be conceived more broadly as a developmental attribute toward which healthy adults of both sexes aspire (*7*). In fact, the items making up the competency cluster have been judged by psychologists and psychiatrists as attributes of mental health (*8*). Incorporation by women of the male-valued stereotypic items, therefore, implies an enhancement of self-concept along a dimension of mental health, maturity, or self-actualization.

The fact that our society tends to prescribe for women a role that entails less competence and maturity than the role prescribed for men has been deemed harmful when viewed from the perspectives of human development and mental health (*8*). In addition, it now

appears that the prescribed feminine sex role is related to problems in population control. Our finding that women who reject in themselves the traits of the feminine stereotype implying low competence and immaturity have significantly fewer children than women who incorporate these undesirable feminine characteristics provides support for Davis's (*2*) and Blake's (*2*) thesis that the stereotypic feminine social role is a critical factor affecting family size in our society.

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Perceptual Restoration of Missing Speech Sounds

Abstract. *When an extraneous sound (such as a cough or tone) completely replaces a speech sound in a recorded sentence, listeners believe they hear the missing sound. The extraneous sound seems to occur during another portion of the sentence without interfering with the intelligibility of any phoneme. If silence replaces a speech sound, the gap is correctly localized and the absence of the speech sound detected.*

We frequently listen to speech against a background of extraneous sounds. Individual phonemes may be masked, yet comprehension is possible. In a study of the effect of transient masking sounds, it was found that replacement of a phoneme in a recorded sentence by a cough resulted in illusory perception of the missing speech sound. Further, the cough did not seem to coincide with the restored sound.

In the first experiment exploring this phonemic restoration effect, 20 undergraduate psychology students were tested. The stimulus was a tape recording of the sentence, "The state governors met with their respective legislatures convening in the capital city," with a 120-msec section deleted and replaced with a recorded cough of the same duration. The speech sound removed (as determined by slow movement past the playback head and confirmed by a sound spectrograph) was the first "s" in the word "legislatures" together with portions of the adjacent phonemes which might provide transitional cues to the missing sound. The subjects were told that, after listening to a cough occurring somewhere in a sentence, they would be given a typewritten statement of the sentence so that they could circle the exact position at which the cough occurred. They were told also that they would be asked whether or not the cough replaced completely the circled sounds. The stimulus was heard binaurally through headphones in an audiometric room at 80 db (peak), and the cough was heard at 86 db (peak) above 0.0002 microbars.

Nineteen subjects reported that all speech sounds were present (the single subject reporting a missing phoneme selected the wrong one). The illusory perception of the absent phoneme was in keeping with the observations of others (graduate students and staff), who, despite knowledge of the actual stimulus, still perceived the missing phoneme as distinctly as the clearly pronounced sounds actually present.

No subject identified correctly the position of the cough, and half the subjects circled positions beyond the boundaries of the word "legislatures." The median distance separating responses from the true position was five phonemes. These errors were rather symmetrically distributed in time, with 11 subjects placing the cough early, and 9 late.

In order to determine whether phonemic restorations could be obtained with another extraneous sound, a second group of 20 subjects was tested under the same procedure except that the cough was replaced by a 1000-hz tone (intensity equal to the peak intensity of the cough). Results similar to those of the first experiment were obtained.

Every subject reported that all speech sounds were present, and no subject identified the position of the tone correctly. Eight subjects circled positions beyond the boundaries of the word "legislatures," the median distance separating responses from the true position was three phonemes, and most subjects (13) placed the tone earlier than its actual position, although this tendency to early placement was not statistically significant.

The inability to identify the position of extraneous sounds in sentences has been reported (*1*). In these studies very brief intrusive sounds (clicks and hisses) were used, and, as considerable care was taken to ensure that no phoneme was obliterated or masked, phonemic restorations were not observed. Inability to identify temporal order is more general than had been thought; it occurs with sequences consisting solely of nonspeech sounds such as hisses, tones, and buzzes. It was suggested that accurate perception of order may be restricted to items which may be linked temporally to form speech or music (*2*).

Phonemic restorations are linked to language skills, which enable the listener to replace the correct sound. The experiments involving the deletion of the first "s" in "legislatures" did not permit the listener familiar with English any choice (that is, no other sound could produce an English word). But, Sherman (*3*) found that when a short cough was followed immediately by the sounds corresponding to "ite," so that the word fragment could have been derived from several words, such as "kite" or "bite," the listener used other words in the sentence to determine the phonemic restoration; when the preceding and following context indicated that the incomplete word was a verb referring to the activity of snarling dogs, the ambiguous fragment was perceived quite clearly as either "bite" or "fight."

Phonemic restorations are not restricted to single phonemes, but may involve deleted clusters of two or three sounds. Also, extraneous sounds other