

## SEX DIFFERENCES IN CARRYING BEHAVIOR<sup>1</sup>

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*Summary.*—Males and females differ in their methods of carrying books. Females wrap one or both arms around their books, which they clasp against the body. Males carry their books in one hand at the side of the body. Sex differences in carrying behavior occur in college students, high school students, and homogeneous adult populations which include elderly people. These differences are widespread in the United States and are found in college students in other cultures. Both male and female college students are individually consistent in their use of sex-typical carrying methods, but males are much more consistent than females. Although size of load affects the sex-typical book-carrying behavior of some females, it has no effect on males' carrying. Males who carried books atypically for their sex scored differently on psychological tests from those who carried typically. This difference was not found in females. There does not seem to be a simple explanation for the sex differences in book-carrying behavior, but psychological, social and cultural, and various biological factors all appear to be involved.

Males and females differ conspicuously in the way they carry books. Females usually clasp books against the body with one or both arms wrapped around the books. Males almost always carry books in one hand at the side of the body. This sex difference in carrying behavior, only one of many behavioral differences between females and males, is so obvious that it is usually overlooked. This paper describes and quantifies book-carrying behavior in several populations and suggests possible reasons for the consistent sex differences. Recently the number of descriptive, analytic studies of human behavior has increased. These studies, by workers from several different branches of the behavioral sciences, contribute to a broad basic understanding of normal human behavior (Birtoun Jones, 1972; Tinbergen, 1972; Hinde, 1972).

Hanaway and Burghardt (1976) found sex differences in the book-carrying methods of grade school, junior high, high school, and college students in Tennessee. Spottswood and Burghardt (in press) examined the relationships among grip strength, book weight, sex, and carrying methods of college students in Tennessee. Sex differences in carrying methods were significant, but the relationships among the variables did not explain these differences.

### METHOD

The study consists of three parts: (1) a comparison of the relative frequency of different carrying methods by females and males; (2) a study of individual consistency in carrying methods and the effect of load size on individual consistency; (3) psychological testing of sex-typical vs atypical carriers. All research was conducted between October, 1974, and February, 1976.

<sup>1</sup>D. Jenni made the drawings, collected data in Coe V. Roca, and reviewed the manuscript. C. Burghardt, L. Hanaway, and P. Spottswood supplied results of their research at the University of Tennessee.

The *carrying methods* of 2626 individuals were observed and recorded. College students were observed on 6 campuses, 3 in the United States, 1 in Canada, and 2 in Central America. High school students were observed at 2 high schools, both in New York, as they approached the school in the morning, and mixed-age adults (estimated 18 to 75 yr.) were observed entering or leaving a public library. I made all observations under natural conditions, never experimenting with or manipulating the subjects. Effort of the observer was minimal, because, even if subjects became aware they were being observed, they never knew what data were being recorded. I obtained a single record of the carrying method of each individual by first choosing arbitrarily a point, classifying the subject's carrying method at the moment he passed that point, then recording the event on a check list. I attempted to record the carrying methods of all individuals who passed the defined point if they carried books without bags or packs.

The classification system used to record data (Fig. 1) divides the 5 most commonly observed carrying methods into two basic types. These five methods could be further subdivided to reflect variation within each, but this scheme provides a small number of apparently discrete categories which can be distinguished easily from one another.

- Type I. Books partially cover front of body. Short edges, approximately parallel to the ground, rest against body. One or both arms wrap around books and support them.
- A. One arm wraps around books. Elbow flexed, forearm on outside of books, fingers wrap around long edges. Short edges rest between hip and front of body under one breast.
  - B. Both arms wrap around books. Both elbows flexed, forearms and hands on outside of books. Fingers wrap around contralateral edges of books or grasp contralateral forearms, wrists, or hands. Books usually centered in front of body, but sometimes shifted to one side.
- Type II. Books at side of body, leaving front of body uncovered. Long edges of books, approximately parallel to the ground, grasped in one hand.
- C. Arm fully extended at side of body. Hand held above books, fingers pointed down, books pinched between thumb and fingers.
  - D. Arm fully extended at side of body. Hand, on outside of books, supports them from below, fingers wrap around lower edges.
  - E. Elbow flexed, books raised along side of body. When books are raised slightly, hand is in same position as in D. When raised higher and tucked under armpit, forearm may be rotated so that long edges of books rest on both hand and forearm.
- Other. Includes a variety of positions characteristic of neither Type I nor Type II. Used less often than A-E and more variable than A-E. For example: (1) books centered in front of body and held by both hands, right hand grasping right edges and left hand grasping left edges (position of books may vary from horizontal to vertical, books may be held away from body or rest against it, or may be held flat against body covering the pelvic area); (2) books grasped between thumb and fingers of one hand and held in front of body about waist level, in any position from vertical to horizontal, usually held away from body; (3) books supported by one hand at shoulder height or higher, held away from body or rested on upper arm, shoulder, or head.

In analyzing the data I combined all methods into three categories, Type I, Type II, and Other, and used  $\chi^2$  to test for significant differences in carrying behavior between females and males in each of the nine groups.

This part of the study required *repeated observations* of the same subjects. Nineteen

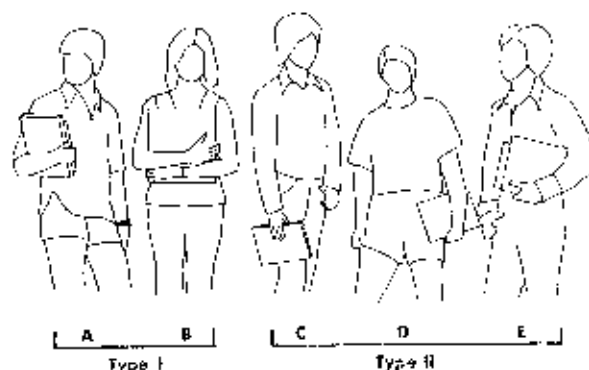


FIG. 1. Five common methods of carrying books. In Type I methods books are clasped against the body; in Type II they are held in one hand at the side.

undergraduates learned to score carrying methods A through E (Fig. 1), then recorded carrying methods of assigned classmates at the University of Montana. Ten independent observations of carrying methods were obtained for each of 33 females and 49 males. For each observation the observer also classified the load carried into one of two categories, "single notebook" or "other." This two-way classification was used because an observer can make the distinction reliably and because the single spiral notebook is standard-sized and is usually the smallest load carried. I did not tell the undergraduate observers that some methods are used more frequently by one sex. To reduce the likelihood that the observer would conclude prematurely that some methods are restricted to one sex, each observed either all females or all males.

I combined Methods A and B into Type I, and C, D, and E into Type II as before, and analyzed each individual's consistency in the use of Type I or Type II methods. Effect of size of load was examined for a subset of the total subjects observed: those whose records included both "single notebooks" and "other." The 14 females and 6 males who carried the same class of load all 10 times were excluded because variability in their carrying methods was independent of load.

Two psychological tests were administered to each of 25 college students to investigate the possibility that individuals who carry atypically for their sex might score differently on the masculinity-femininity scale from those who carry typically. The two tests were the California Psychological Inventory (Guogh, 1966) and the Revised Concept Meaning Measure (Sapientfield, 1968).

Subjects were classified as "typical" or "atypical" on the basis of a single observation of their book-carrying method. Although participation was optional, at least two of the approached subjects agreed to take the tests. None of the individuals tested knew they had been selected on the basis of their carrying behavior nor that the study involved either carrying behavior or masculinity-femininity scales. I used the Mann-Whitney  $U$  test to compare test scores of "typical" and "atypical" groups for each sex.

#### RESULTS

Females and males differ significantly in their carrying behavior in all 6 colleges, both high schools, and the public library ( $p < .001$ , Table 1). In each of the 9 samples: (1) more females than males use Type I methods and more males than females use Type II; (2) Method A is the Type I method used

TABLE 1  
PERCENTAGE OF FEMALES AND MALES USING TYPE I, TYPE II,  
AND OTHER CARRYING METHODS

Area	Type of Carrying						N		$\chi^2$
	Females			Males			Females	Males	
	I	II	Other	I	II	Other			
Colleges									
U. Montana	92	8	0	5	95	0	133	121	194.16
Cornell U.	85	14	2	4	96	0	229	402	435.87
Ithaca Col.	86	10	4	1	96	3	114	150	172.66
U. Toronto	69	27	5	4	91	6	81	108	92.25
U. Costa Rica	90	10	1	1	99	0	162	117	217.21
U. El Salvador	68	29	3	1	99	0	217	246	250.52
High Schools									
N.Y. (10-12)	95	3	2	0	100	0	154	111	249.14
N.Y. (9-12)	94	6	0	0	100	0	72	55	111.82
Adults									
Library, N.Y.	70	13	17	2	83	15	134	65	104.03

most frequently by females and Method D is the Type II method preferred by males; (3) females use Type II methods more often than males use Type I.

The sex differences in carrying behavior are large. In the six colleges combined, 82% of females use Type I methods, compared with only 3% of males; and 96% of males use Type II methods, compared with 16% of females. "Other" methods, characteristic of neither sex, are used by only 2% of females and 1% of males. The difference between the sexes is even larger in the high schools. For the two high schools combined, 95% of females use Type I, compared with 0% of males; and 100% of males use Type II, compared with 4% of females. The Other methods are almost never used by either sex. The difference decreases in the mixed-age adults, because both females and males use Other methods more often than college and high school students. There is no increase in the number using methods typical for the opposite sex.

The carrying behavior samples from all six colleges have the same general form, but there are significant differences among them (Table 1). In females, the number who use Type I, Type II, or Other methods differs among the six colleges ( $\chi^2 = 59.85$ ,  $df = 10$ ,  $p < .001$ ). There is no difference in carrying methods of females at Cornell University and Ithaca College, both located in Ithaca, N. Y. ( $\chi^2 = 2.98$ ,  $df = 2$ ,  $.20 < p < .30$ ). There is no difference between the University of Montana and the University of Costa Rica ( $\chi^2 = 1.35$ ,  $df = 2$ ,  $.50 < p < .70$ ); in both a higher proportion of females use Type I than in the New York colleges. Carrying behavior of females does not differ between the University of Toronto and the University of El Salvador ( $\chi^2 = 0.20$ ,  $df = 2$ ,  $.90 < p < .95$ ); in both fewer females use Type I than in the other colleges.

In males the number who use each type of carrying behavior also differs among the six colleges ( $\chi^2 = 43.52$ ,  $df = 10$ ,  $p < .001$ ; Table 1). There is

no difference in the carrying behavior of males at Cornell University and the University of Montana ( $\chi^2 = 0.31$ ,  $df = 2$ ,  $.80 < p < .90$ ). At Ithaca College the proportion of males who use Type II methods is the same as at Cornell and Montana, but fewer use Type I and more use Other methods. There is no difference between the University of Costa Rica and the University of El Salvador ( $\chi^2 = 0.36$ ,  $df = 2$ ,  $.70 < p < .80$ ); in both a higher proportion of males use Type II methods than at the other colleges. At the University of Toronto fewer males use Type II methods than at the other colleges but no more use Type I; the difference is the result of more males using Other methods.

Of the 43 females on whom 10 observations were obtained 56% used Type I carrying methods all 10 times, 35% used both Type I and Type II, and 9% used Type II all 10 times (approximate 95% confidence limits, with correction for continuity:  $.56 \pm .16$ ,  $.35 \pm .15$ ,  $.09 \pm .10$ ). Of the 19 males in the sample 90% used Type II all 10 times, 10% used both Type I and Type II, and 0% used Type I all 10 times ( $.90 \pm .09$ ,  $.10 \pm .09$ ,  $.00 \pm .07$ ).

Effect of load on carrying behavior was examined individually for the 29 females and 13 males that carried different sized loads. Fifteen of the females used the same type of carrying (either only Type I or only Type II) all 10 times regardless of kind of load carried. The other 14 tended to use Type II (Methods C or D but never E) when carrying a single notebook and Type I when carrying other loads (Kuder-Richardson 20,  $r = 0.78$ ). Males used Type II methods almost exclusively for both kinds of loads. The 5 males who used Type I occasionally used it equally often for both kinds of loads. Kind of load appeared to affect which Type II method males used. Both single notebooks and other loads were carried most often by Method D, but single notebooks were carried by Method C more often than E (33% vs 7%) and other loads were carried by Method E more often than C (20% vs 11%).

Data collected by the 19 independent observers is consistent with data comparing female and male carrying methods in college and high school students and mixed-age adults. These data also show: (1) females use Type I carrying methods more often than Type II; (2) males use Type II methods more often than Type I; (3) females use typically male methods more frequently than males use female methods; and (4) females use Method A most frequently and males use Method D most frequently.

Only two males in a university class with 199 males enrolled were ever observed using the Type I carrying methods typical of females. These two males scored significantly higher on the femininity scales than five males in the "typical" group ( $U = 0$ ,  $p < .05$ , for both tests). Both males in the "atypical" group, who were selected for testing on the basis of a single observation of Type I carrying behavior, were observed using both Types I and II carrying methods. There were no differences in femininity scores on either test between the 10 females in the "atypical" group and the 8 females in the "typical" group.

## DISCUSSION

Sex differences in book-carrying methods are widespread. The three United States colleges represent two widely separated geographic areas, Missoula, Montana, and Ithaca, New York. Sex differences in carrying methods are also found at the University of Tennessee (Hanaway & Burghardt, 1976). The similar results from colleges in the United States, Canada, El Salvador, and Costa Rica indicate that sex differences in the carrying behavior of college students are cross-cultural.

Such behavior for high school students appears to be widely distributed also. The two New York high schools are very different: one is a large (1800 students), urban school restricted to Grades 10 to 12; the other is a smaller (400 students), suburban-rural school with Grades 9 to 12. Sex differences are also found in carrying behavior of Tennessee high school students (Hanaway & Burghardt, 1976) and in Montana high schools (personal observation).

It was evident from observations at the public library that sex differences in carrying behavior persist into old age. This was demonstrated dramatically by a number of elderly couples who came to the library together, each carrying books using a method typical for his or her sex. A diverse age range, approximately 18 to 75 yr., was represented at the library, and sex differences in carrying behavior were observed in all ages.

There are cross-cultural sexual differences in methods of carrying other kinds of loads, as well as books. In Guatemala, El Salvador, Honduras, and Nicaragua, females very frequently carry loads on their heads, while males almost never do. Males usually carry loads on their shoulders or backs, while females almost never do. In a sample of 499 people observed walking on or beside the highway in the four countries, females and males differed significantly (load on head vs shoulders or back) in each country ( $p < .001$ ).<sup>2</sup> However, many more variables are involved than in book-carrying behavior, the major one being the sex-related differences in kind of load carried. Females more often carry baskets and tubs of produce and jugs of water; males more often carry stacks of wood, logs and long handled tools, and large filled gunny sacks.

Size or weight of books does not adequately account for the consistent sex differences in carrying behavior. Although some females often switch to male methods when carrying single textbooks, other females never do. Males almost never use female methods for any size load. In general, size of load is a very poor predictor of method of carrying, while sex predicts very accurately. It seems likely that sex differences in strength and body shape affect carrying be-

and males had significantly greater grip strength than females (Sportswood & Burghardt, in press). An analysis of the interactions among the four variables, book weight, grip strength, sex, and carrying method, did not suggest an explanation for the significant sex differences in carrying methods.

Social pressure and imitation may affect carrying behavior. High school students of both sexes adhere even more strictly to sex-typical carrying methods than college students. This may relate to the high school social context in which sex role attributes and sexual status are stressed and to adolescents' tendency to conform to their own cultural norms (e.g., Gordon, 1972; Mussen, Conger, & Kagan, 1974). The mixed-age adults at the public library were more varied in their carrying behavior than high school and college students. This may reflect the lack of a common social context and less concern with conformity, but other factors must be considered: they presumably carried books less frequently; size, shape, and number of books varied more; they frequently carried parcels and purses in addition to books; and they frequently were accompanied by young children held by the hand.

The influence of social pressure is also suggested by the finding that more females use male carrying methods than the reverse. In general, a higher proportion of adolescent females than males adopt aspects of the opposite sex role, and females are less likely to be ridiculed or otherwise punished for opposite-sex behavior than are males (Lynn, 1969).

Results of the psychological tests suggest the possibility that opposite-sex carrying in males may be related to personality variables. Masculinity-femininity scales tend to measure conformity to traditional male and female stereotypes (Bein, 1974). Males who occasionally carry books atypically for their sex may also be nonconforming to the male stereotype in personality traits and interests, as suggested by their high scores in femininity on both tests. The sample of males who carry atypically is small for good reason: it is extremely rare for males to use typically female carrying methods. Considering the scarcity of males who use female methods even occasionally, it is not so surprising that they differ on personality tests from the overwhelming majority of males who never do. Females who carried atypically for their sex did not differ from the typical carriers, but classification into "atypical" or "typical" groups was based on a single observation. Results of the study of individual consistency establish that a rather high proportion of females use both carrying methods.

There is a striking difference in the degree of accessibility of the body depending upon whether typically female or male book-carrying methods are used. Claspng books against the body partially covers the front of the body and requires a somewhat closed position of one or both arms. Carrying books in one hand at the side of the body leaves the front of the body unobscured and both arms in an open position. Similar sex differences in relative accessibility of the body have been reported in other studies. In static postures there is a

general tendency for females to assume somewhat closed positions of the limbs and males to assume open positions, based on a study of 480 cultures (Hewes, 1957). Sex differences in the arrangement of the limbs are also found in monkeys and apes; male monkeys and apes assume open arrangements of the limbs in sitting postures, similar to male humans (Wickler, 1969). In therapy sessions some females indicate tenseness by assuming closed positions of the limbs, not only crossing their knees but winding the upper instep around the lower ankle, often crossing their arms over their chests at the same time (Berne, 1972). Sex differences occur during social interactions in both degree of accessibility of the body (Mehrabian, 1968) and degree of symmetry in the arrangement of the arms and legs (Mehrabian, 1972). In social situations females tend to arrange their arms and legs more symmetrically than males, and more symmetry indicates less relaxation. Method B (Fig. 1) is the only common book-carrying method which results in a closed position of both arms and in which the arms are arranged symmetrically. As posture and body motion studies would predict, this method of book-carrying is used very frequently by females and almost never by males.

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