STUDIES IN MOTION SICKNESS

Series B

Reports on research administered by Wesleyan University by means of grants-in-aid from the National Research Council Committee on Selection and Training of Aircraft Pilots from funds provided by the Civil Aeronautics Administration.

April 1946

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Report No. 60
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National Research Council

Committee on Selection and Training of Aircraft Pilots

Executive Subcommittee

M. S. Viteles, Chairman

E. C. Andrus	J. C. Flanagan
C. W. Bray	W. R. Miles
D. R. Brimhall	P. J. Rulon

LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue, Washington, D. C.
Division of Anthropology and Psychology

Committee on Selection and Training of Aircraft Pilots

April 5, 1946

Dr. Dean R. Brimhall
Director of Research
Civil Aeronautics Administration
Room 3895, Commerce Building
Washington 25, D. C.

Dear Dr. Brimhall:

Attached is a report entitled Studies in Motion Sickness, Series B, embodying three studies conducted by G. R. Wendt under grants administered by Wesleyan University. This report is submitted by the Committee on Selection and Training of Aircraft Pilots with the recommendation that it be included in the series of Technical Reports issued by the Division of Research, Civil Aeronautics Administration.

This is the second of a series of reports on studies conducted by G. R. Wendt during the years 1940-1943. It is of interest to note that the studies by G. R. Wendt, under grants from the Committee on Selection and Training of Aircraft Pilots, from funds provided by the Civil Aeronautics Administration, laid the foundation for later research carried out by him under the auspices of the Committee on Aviation Medicine, Office of Scientific Research and Development.

Cordially yours,

Morris S. Viteles, Chairman
Committee on Selection and
Training of Aircraft Pilots
National Research Council

MSV:rm

FOREWORD

This report is the second of a series describing investigations on motion sickness administered by Wesleyan University under grants-in-aid from the National Research Council Committee on Selection and Training of Aircraft Pilots. These studies were designed to examine the frequency of susceptibility to motion sickness and the relationship of susceptibility to previous history of such illness.

Acknowledgment is due to Dr. A. D. Tuttle, Medical Director of the United Air Lines, for making possible the collection of the data and cooperating closely on the second study in this series. Thanks are also expressed to colleagues at college and university centers who made student groups available for these investigations, as well as to the students, stewardesses, and others who participated in the study.

CONTENTS

STUDIES IN MOTION SICKNESS

Series B

I

FREQUENCY OF SUSCEPTIBILITY TO MOTION SICKNESS AMONG YOUNG ADULTS

by

G. R. Wendt
Head, Department of Psychology
University of Rochester

SUMMARY

A series of questionnaire surveys was made by means of which the frequency of susceptibility to motion sickness among young adults was estimated. The groups reported in this study included seven groups of college students and a group of airline stewardesses. The questionnaires included items on sea, train, auto, street car and bus travel, and on elevators, lawn swings and amusement park devices. Four forms of questionnaires were used. Some groups were assembled for questionnaire; others completed it without supervision. The results have been presented for normative purposes. Such norms are useful both in the evaluation of the practical importance of the problem of motion sickness and for guidance in construction of motion sickness inventories or estimates of their possible usefulness as predictive devices.

According to the over-all data, taking no account of type of subject or form of question, among transportation devices boats were most frequently rated as nauseating, 42%; then buses, 25%; autos, 24%; street cars, 11%; and finally trains, 10%. The obtained percentages varied, however, depending upon the form of the question. For instance, the reported frequency of susceptibility on boats was 53% when the subjects were asked to report whether they had ever, at any age, been susceptible and were required to answer for each of three or four age periods; 46% when asked a similar question requiring less detail in the reply; 36% when asked "Have you ever been seasick?" and required to answer by "Yes," "No" or "Slightly"; and only 31% when the subjects were asked to state whether they would be affected by a future ride. Questions concerning susceptibility at various age levels showed the greatest frequency at the grade school ages. Comparison of women and men, on comparable questionnaire forms, showed that women reported more motion sickness than men and that accepted pilot applicants had less sickness in their histories than other college students.

FREQUENCY OF SUSCEPTIBILITY TO MOTION SICKNESS AMONG YOUNG ADULTS

INTRODUCTION

This study is one of a series of investigations[1] concerned with motion sickness susceptibility undertaken by Dr. G. R. Wendt at Wesleyan University under the auspices of the National Research Council Committee on Selection and Training of Aircraft Pilots. The frequency of susceptibility to motion sickness was obtained on four forms of questionnaires for seven groups of college students and a group of airline stewardesses. The results are presented for normative purposes, since such data are useful both in the evaluation of the practical importance of the problem of motion sickness and for guidance in construction of motion-sickness inventories or estimates of their possible usefulness as predictive devices.

METHODS

A. The questionnaires. The four questionnaires used represent a progressive development from a form made up in February, 1940, through two long forms of June, 1940, and of January 14, 1941, to a short form of December, 1941. Copies of these are included in Appendix A of this report. Each questionnaire was accompanied by appropriate explanatory material when given to the subjects.

B. Experimental groups and methods of administration of questionnaire.

1. Student body, Wesleyan University, February, 1940, (N = 624). The Wesleyan student body (all male) took the questionnaire of February, 1940, in small assembled groups at fraternity houses and at the student union building. Of a total student body of approximately 725 students, 624 completed questionnaires. Because of the large proportion of returns, it may be assumed that no great sampling errors are involved.

2. Wesleyan University entering class, September, 1940, (N = 199). These subjects (all male) took our questionnaire of June, 1940, as a part of the freshman testing program under supervised administration. All entering students participated.

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[1] For other studies of motion sickness conducted by the author under the auspices of the Committee on Selection and Training of Aircraft pilots, see: Wendt, G. R. Motion sickness in aviation. NRC Division of Anthropology and Psychology, Committee on Selection and Training of Aircraft Pilots, May 1944. Also, Wendt, G. R. Studies in motion sickness. Series A. Washington, D. C.: CAA Division of Research, Report No. 40, December 1944.

3. Students in psychology classes at various universities during the summer of 1940 (N = 243). Through the courtesy of colleagues, 243 students in psychology classes at various universities completed our questionnaire of June, 1940. They were not assembled for this purpose. The schools involved were:

	N
Brooklyn College	85
Columbia University	28
New York University	11
University of Rochester	30
University of Michigan	13
University of Virginia	28
George Washington University	21
University of Missouri	24
Purdue University	3

Selective factors were possibly operative in this group; namely, their membership in psychology classes and in summer sessions. We have no information on selection of summer session students with relation to motion sickness susceptibility, but tabulation of data at Wesleyan University showed that more susceptibles took psychology courses than did non-susceptibles.

4. College students who were also student airplane pilots during the summer and fall of 1940 (N = 197). Through the courtesy of colleagues, 197 college student pilots or accepted pilot applicants completed the questionnaire of June, 1940. They were not assembled. Seven or more subjects above normal college age appear in this group and are included in our calculations. The schools involved were:

	N
University of Michigan	89
University of Rochester	47
Purdue University	50
University of Virginia	6
Brooklyn College	3
Columbia University	2

5. United Air Line stewardesses (N = 189). Through the courtesy of Dr. A. D. Tuttle, Medical Director of United Air Lines, all stewardesses in the employ of the company in February and March of 1941 completed our questionnaire of January 14, 1941. They were not assembled.[2]

6. Brown University female students in psychology, spring of 1942, (N = 109). Through the courtesy of colleagues, our questionnaire of

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[2]For further details of a study involving this group, see the second report in this Series.

December, 1941, was administered during classes, under supervision.

7. Brown University male students in psychology, spring of 1942, (N = 293). These questionnaires were obtained in the same way as those of the women students. Other data on this group have been reported in a previous paper.[3]

8. Harvard College students, spring of 1942, (N = 245). In connection with an investigation of the relationship between somatotype[4] and motion-sickness history, Dr. W. H. Sheldon and Dr. S. S. Stevens sent us the names of three groups of Harvard students selected from their files on the basis of certain hypotheses concerning relationships of body-form to susceptibility. These hypotheses were that individuals with a second component (mesomorphy) of 5 or higher would tend to be non-susceptible; that individuals with a third component (ectomorphy) of 5 or higher would tend to be susceptible; and that individuals in whom both the first and third components were higher than the second component, for example, a 4-2-4, would tend to be susceptible. Out of a total of 306 students circularized, 253 sent back questionnaires. Eight of these were rejected for incompleteness. The three groups turned out to be similar so far as total history of motion sickness was concerned, so they are included in this paper as a fair sample of Harvard students. The motion-sickness history scores[5] obtained on the questionnaires showed that for the high second component the median motion-sickness history score was 33, the interquartile range was 10, the N was 108; for the high third component the median score was 34, the interquartile range was 11, the N was 109; for the high first and third component the median score was 30, the interquartile range was 12, the N was 28. The average scores of the same groups were 29.7, 31.4, and 29.6.[6]

Age of subjects. The age distribution of the subjects in each group is shown in Table 1.

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[3]Lindsley, D. B., and Wendt, G. R. An investigation into the relationship of the electroencephalogram to motion sickness susceptibility. In Studies in motion sickness. Series A, (see Footnote 1).

[4]Sheldon, W. H., and Stevens, S. S. The varieties of temperament. New York: Harper and Bros., 1942.

[5]The scoring method is described in a previous report. See: Alexander, S. J., Cotzin, M., Hill, C. J., Ricciuti, E. A., and Wendt, G. R. Wesleyan University studies of motion sickness: VI. Prediction of sickness on a vertical accelerator by means of a motion-sickness history questionnaire. J. of Psychol., 1945, 20, pp. 25-30.

[6]The scoring system is such that low scores indicate a history of sickness; high scores indicate freedom from sickness. The obtained differences between the first and second groups are therefore in a direction contrary to the hypothesis of the investigation. The magnitude of the difference is, however, too small to show a true difference.

TABLE 1

AGE DISTRIBUTION OF SUBJECTS FOR EACH GROUP

Age in Years	Wesleyan Student Body	Wesleyan Entering Class	Students from Other Schools	Pilots	Stewardesses	Brown Students Female	Brown Students Male	Harvard Students
14		1						
16		7				2	1	
17	17	48	10			9	17	1
18	96	84	33	9		22	72	12
19	173	38	41	42		27	72	43
20	153	10	45	42		28	73	54
21	117	1	30	23	1	15	35	76
22	47	1	23	29	17	3	10	52
23	13		12	21	34	1	4	5
24	6		17	15	44		1	2
25	1		10	8	40			1
26			3	1	23		1	
27			3		9		4	
28			5	1	7	1		
29	1		4	2			1	
30					5			
31				1	3			
33			1	1	1			
35			1			1		
36			1		1			
37			1	1				
40			1					
41			1					
43			1					
52				1				
No Answer		9			4		2	

RESULTS

The frequency of response to each item was determined for each group. The results are here presented in terms of percentages who replied to each item. Each group is first presented separately and then certain over-all comparisons are made.

1. Student body, Wesleyan University, (N = 624). The questionnaire of February, 1940, was, in our opinion, not a good one for the present statistical purposes in that the items requiring a report on actual instances of sickness were phrased in such a manner that the answers of those

without experience and of those with experience but without sickness, could not be distinguished without unwieldy treatment of results. Moreover, some of the frequencies of reported susceptibility to sickness were so far below the frequencies actually observed among similar populations as to lead to the conclusion that this questionnaire seriously underestimated some categories. This error was probably maximum in the case of seasickness and airsickness, where many lacked experience, and minimum in the other vehicles. Incomplete questionnaires were fairly numerous. Tables 2 to 6 show the obtained data. Our analysis omits replies to some questions as may be seen by reference to the copy of the questionnaire (see Appendix A-1).

TABLE 2

I predict that I would (1) become sick to the point of vomiting, (2) become queazy, pale and feel very uncomfortable, (3) be slightly affected, (4) be completely unaffected, (x) insufficient experience to make a judgment.

	1	2	3	4	x	No Answer
Four-hour sea voyage in moderate wind	1.7	3.3	16.8	51.1	26.1	0.8
Four-hour train trip	0.1	0.4	6.8	91.0	1.4	0
One-hour street car ride	0.3	1.7	11.2	80.2	5.6	0.8
Four-hour auto trip as passenger	0.6	2.5	15.0	81.0	0.1	0.4
Three-hour plane trip	0.4	2.4	8.1	19.8	68.8	0.9
Average	0 6	2.1	11.6	64.6	20.4	0.6

In Table 2 are given the students' own predictions of susceptibility on boats, trains, cars, autos and planes in terms of the per cent of the total group choosing each of several predicted degrees of sickness. Only one alternative was allowed in answer to each question. If we depend on answers found in column 4 (predictions that they would be "unaffected" by a trip) to judge relative susceptibility, it is observed that the relative rank from most nauseating to least nauseating is: 1. planes, 2. boats, 3. street cars and autos, and 4. trains.

Table 3 shows amount of experience on each vehicle. Column 4 shows at a glance the frequency of complete lack of experience. Almost all had been on autos, trains and street cars, most on boats, but less than half on planes. Special factors affecting this Wesleyan group were: 1. sea; the student body was drawn from sea-coast states; 2. train; Middletown, Connecticut, was reached by train travel primarily; 3. plane; the Wesleyan group included few wealthy and relatively few very poor students.

Table 4 shows frequency of recent experiences of sickness. The interpretation of the term "recent" was left to the student to define (with a probable loss of reliability in the item). The seasickness data are confused by the fact that alternative 4 (never sick) was chosen by some who should have chosen alternative x (insufficient experience). In the case of the other vehicles inexperience was less common, so the obtained data are more nearly correct. If we lump together all instances of recent

sickness (alternatives 1, 2, and 3), the rank of the various vehicles in terms of per cent of the total group affected is: 1. autos, 19.1% affected; 2. boats, 18.1%; 3. street cars, 6.4%; and 4. trains, 4.9%. The relatively high frequency in the case of autos is perhaps in part due to the greater opportunity which the subjects had to become sick in them. The frequency of sickness on boats would probably have increased considerably if the 80% with occasional, little, or no experience had increased their experience.

TABLE 3

I have taken voyages or trips (1) often, (2) occasionally, (3) rarely, (4) never.

	1	2	3	4	No Answer
Sea	16.0	33.3	28.6	18.1	3.8
Train	60.4	31.0	6.8	0.6	0.9
Street car	48.2	33.4	13.6	1.4	3.2
Auto	92.4	5.4	0.9	0	1.1
Plane	2.2	14.5	27.5	52.5	2.4
Average	43.8	23.5	15.5	16.5	2.3

TABLE 4

In the recent past I have become sick (1) usually, (2) sometimes, (3) rarely, (4) not at all, (x) insufficient experience.

	1	2	3	4	x	No Answer
Sea	2.0	7.9	9.1	51.6	29.0	1.1
Train	0.1	1.2	3.6	91.6	2.8	0.3
Street car	0.4	2.5	3.5	83.8	8.9	0.6
Auto	0.9	6.2	12.0	80.6	0	0.1
Average	0.9	4.2	7.1	76.9	10.2	0.5

Table 5 shows self-ratings of susceptibility at various times during and since childhood. The subjects were allowed to check as many alternatives on these questions as were descriptive of them. On all vehicles, susceptibility was most frequent in grade school years and dropped off with increasing age. Reported pre-school susceptibility was relatively low. We are inclined to attribute this to lack of opportunity for sickness and to loss of memory of it, rather than to a true resistance to sickness in early childhood. Alternative 5 (never susceptible) gives the same rank order of susceptibility as is shown for alternative 4 in Table 2; i.e., that seasickness susceptibility is most frequent, then autos and street

cars, and lastly trains. Sickness in autos does, however, show up more frequently in this total history report than it does in the previous questions (see Tables 2, and 4).

TABLE 5

I am or was susceptible to sickness (1) now, (2) during high school years, (3) during grade school years, (4) during pre-school years, (5) never, (x) insufficient experience to make a judgment.

	1	2	3	4	5	x	No Answer
Sea	7.0	13.3	13.9	6.3	46.6	27.0	0.8
Train	1.4	1.9	3.6	3.0	88.4	3.3	0.3
Street car	3.3	3.3	4.1	3.0	83.8	6.0	0.4
Auto	7.5	9.7	19.0	9.4	69.0	0.3	0
Average	4.8	7.1	10.2	5.4	72.0	9.2	0.4

Table 6 shows reports of nausea in movies, from flickering light, in elevators and on amusement park devices. The table is self-explanatory and contains no especially notable results, unless it be that one out of twelve college students reported being nauseated by movie attendance.

TABLE 6

In the following list indicate any situations which have, within the last two years, made you feel nauseated to any degree.

	Yes	No	No Experience	No Answer
Motion pictures	7.3	89.1	0.6	2.8
Driving past trees through which the sun flickers	8.1	83.8	4.4	3.5
Merry-go-round	13.9	70.6	12.5	2.8
Ferris wheel	8.0	65.0	23.7	3.2
Airplane glider	5.6	25.1	66.0	3.2
Elevator	12.9	82.8	1.6	2.5
Loop-o-plane	14.2	25.0	57.8	2.8
Lindy-loop	7.6	23.2	64.9	4.1
Roller coaster	14.1	67.1	16.3	2.4
The Whip	12.5	59.4	25.4	2.4
Average	10.4	59.1	27.3	3.0

2. Wesleyan University entering class (N = 199). The data obtained from the June, 1940, questionnaire were much more satisfactory than those from the earlier version. This questionnaire included unambiguous questions on actual occurrence of sickness. Furthermore, there were no incomplete questionnaires in the group. Like the earlier one, this questionnaire showed some curious underestimations of susceptibility on the part of the students. For instance, no student rated himself as likely to become seasick during a four-hour voyage in a moderate wind. It is a safe estimate that in fact at least 10% would become sick. The results are presented in Tables 7 to 11. Twenty questions are omitted from this analysis because the information appearing in them did not seem to be worth the trouble of analysis.

TABLE 7

Have you ever been:

	Yes	Slightly	No	N included in group
Seasick	18.1	25.3	56.4	154
Train sick	6.1	3.5	90.2	195
Car sick (street car or subway)	5.0	4.5	90.4	198
Car sick (autos)	23.1	12.0	64.8	199
Average	13.1	11.3	75.5	

Table 7 shows the percentage frequency of actual cases of sickness on boats, trains, street cars or subways, and automobiles. In the calculation of these percentages only those cases were used who had experience. The included cases are those who raported experience "often," "occasionally," and "rarely." If we accept the "no sickness" column as the most valid index of resistance to sickness, sea voyages are seen to have been the most nauseating, then auto trips, with train and street car or subway rides least. Among those reporting frank sickness (the "yes" column), automobiles are in the lead, then boats, with trains and cars last. It seems a reasonable conjecture that autombiles rank high in part because of the very much greater frequency of use.

Table 8 shows self-ratings of what would happen if they made a future trip. Boats are given first place as potential causes of sickness, then autos, with trains and cars last. There was a strong tendency for the subjects to predict that they would be "slightly affected" rather than predicting "nausea and vomiting," since only one out of 199 judged that he would become frankly sick on any vehicle. This questionnaire result is denied by all experience tables.

TABLE 8

Under ordinary circumstances, under the stated conditions, I would (1) become very sick, to the point of nausea and vomiting, (2) become queazy, pale, and feel uncomfortable, (3) be only slightly affected, (4) be unaffected.

	1	2	3	4
Four-hour sea voyage in moderate wind	0	4.5	22.1	73.3
Four-hour train trip	0	1.0	7.5	91.4
One-hour street car or subway ride	0	0.5	6.0	93.4
Four-hour auto trip as passenger	0.5	2.5	9.5	87.4
Average	0.1	2.1	11.3	86.4

Table 9 deals with amount of experience. Frequent experience was common only in autos (94.9%); was unusual in boats (10%). Complete lack of experience was significant only for boats (22.6%).

TABLE 9

I have taken voyages or trips (1) often, (2) occasionally, (3) rarely, (4) never.

	1	2	3	4
Sea	10.0	32.6	34.6	22.6
Train	52.2	35.6	10.0	2.0
Street car or subway	64.3	29.6	5.5	0.5
Auto	94.9	4.5	0.5	0
Average	55.4	25.6	12.7	6.3

Table 10 summarizes an approach to the same question as Table 8, but in a slightly different way. The subjects were asked whether they were "now susceptible," rather than for a specific prediction. In addition, reports on past susceptibility were required. The over-all results seem more in line with experience tables, but there is a small peculiarity in that on boats and cars the high school period was rated relatively low for susceptibility, while one might expect it to be rated higher than present susceptibility. Comparison of vehicles can best be made by reference to column 4, "never susceptible," where they stand in the rank, boats, autos, trains and cars, boats being worse.

Table 11 shows reports of sickness on other devices, including amusement park devices. The table contains no especially notable results.

TABLE 10

I am or was susceptible to sickness (1) now, (2) during high school years, (3) during grade school years, (4) never, (5) insufficient experience.

	1	2	3	4	5
On boats	7.0	3.0	10.5	46.2	33.1
On trains	2.0	2.5	5.0	85.9	4.5
On street cars, subways	1.5	0.5	3.5	89.4	5.0
In autos	4.0	5.5	19.5	68.3	2.5
Average	3.6	2.9	9.6	72.5	11.3

TABLE 11.

Indicate whether the following have, within the last four years, made you feel nauseated to some degree.

	Yes	No	No Experience
Elevator	11.0	88.4	0.5
Hammock	5.0	86.9	8.0
Lawn swing	10.0	83.4	6.5
Merry-go-round	6.5	87.4	6.0
Ferris wheel	6.0	76.3	17.5
Airplane glider	6.5	33.6	59.7
Loop-o-plane	14.5	34.6	50.7
Lindy-loop	5.5	26.6	67.8
Roller coaster	12.0	68.8	19.0
The Whip	12.5	65.8	21.6
Average	9.0	65.2	25.7

3. Students in psychology classes at various universities during the summer of 1940 (N = 243). These students took the June, 1940, questionnaire and the same analyses were made. It should be noted that about half of the subjects were from "inland" universities. The group was much less homogeneous than the Wesleyan group. The results are presented in Tables 12 to 16.

Table 12 shows the frequency of actual sickness among those with some experience on each vehicle. The general relations are different in respect to the ranking of trains and cars from those found for the Wesleyan group, reports of "no sickness" being least frequent on boats, then autos, cars, and finally trains. Among those reporting frank sickness (the "yes" column) the ranks were the same. These students also

differed from the Wesleyan group in reporting smaller frequencies of sickness in boats and autos, and larger on street cars and subway trains. This may be a consequence of the inclusion of a large New York City group.

TABLE 12

Have you ever been:

	Yes	Slightly	No	N included in group
Seasick	20.9	13.0	66.0	153
Train sick	7.9	4.2	87.8	238
Car sick (street car or subway)	8.7	10.7	80.4	241
Car sick (autos).	12.5	10.4	76.9	239
Average	12.5	9.6	77.8	

Table 13 shows self-ratings of probable future sickness. Boats were predicted to be most nauseating, then autos, trains, and finally cars. This sequence follows that shown in the preceding table and differs in the same way from the ranks by the Wesleyan group displayed in Table 8. As in the Wesleyan group, few predicted that they would become sick to the point of vomiting, although many predicted lesser sickness. In over-all results more of these summer session psychology students believed themselves susceptible than did Wesleyan students.

TABLE 13

Under ordinary circumstances, under the stated conditions, I would (1) become very sick, to the point of nausea and vomiting, (2) become queazy, pale and feel uncomfortable, (3) be only slightly affected, (4) be unaffected.

	1	2	3	4
Four-hour sea voyage in moderate wind	1.6	8.2	30.8	59.2
Four-hour train trip	0.4	3.7	10.6	85.1
One-hour street car or subway ride	0.4	2.8	7.4	93.4
Four-hour auto trip as passenger	0.8	2.0	13.9	83.1
Average	0.8	4.2	15.7	80.2

Table 14 displays data on amount of experience. More than one-third had never been on boats, but the numbers without experience in trains, cars, and autos were negligible. As a total group they had more exper-

ience on street cars and subways than did the Wesleyan group, less on the other vehicles. The inclusion of 134 New York City students perhaps accounts for these differences.

TABLE 14

I have taken voyages or trips (1) often, (2) occasionally, (3) rarely, (4) never.

	1	2	3	4	No Answer
Sea	7.3	23.8	30.0	37.0	1.6
Train	44.0	37.0	16.0	2.0	0.8
Street car or subway	76.9	16.0	5.3	0.8	0.8
Auto	84.3	12.3	1.6	1.6	0
Average	53.1	22.3	13.2	10.4	0.8

Table 15 shows susceptibility at various age levels. The over-all results are very close to those obtained with the Wesleyan group; susceptibility decreased with increase in age. Column 4 ("never susceptible") shows that susceptibility had been most frequent on boats, then autos, and least on cars and trains.

TABLE 15

I am or was susceptible to sickness (1) now, (2) during high school years, (3) during grade school years, (4) never, (5) insufficient experience.

	1	2	3	4	5	No Answer
On boats	4.5	5.7	3.7	43.2	41.5	1.2
On trains	2.8	1.2	4.1	83.1	8.2	0.4
On street cars or subways	5.3	2.8	7.8	82.3	1.6	0
In autos	5.3	6.1	7.4	78.6	2.4	0
Average	4.5	4.0	5.8	71.8	13.4	0.4

Table 16 shows reports on other devices. The "no experience" column is interesting by comparison with the Wesleyan group in that the percentages are all higher, except for elevators. Otherwise the results are similar.

TABLE 16

Indicate whether the following have, within the last four years, made you feel nauseated to some degree.

	Yes	No	No Experience	No Answer
Elevator	13.1	86.4	0.4	
Hammock	9.8	73.6	16.4	
Lawn swing	12.3	72.4	15.2	
Merry-go-round	6.5	80.2	13.1	
Ferris wheel	5.7	68.7	25.5	
Airplane glider	5.7	23.0	71.1	
Loop-o-plane	9.0	24.2	66.2	0.4
Lindy-loop	4.1	23.4	72.4	
Roller coaster	12.7	63.3	23.8	
The Whip	11.5	63.7	24.6	
Average	9.0	57.9	32.9	0.04

4. College students who were also student airplane pilots during the summer and fall of 1940 (N = 197). These students took the same questionnaire as the two preceding groups. Except for a scattering few they were "inland" students. The group was homogeneous only with respect to having piloted planes and being college students. The results are displayed in Tables 17 to 21.

Table 17 shows actual sickness among those with experience. The rank order of effectiveness in producing sickness was the same as for the summer session psychology students: boats, autos, cars, trains. The ranks are not altered when frank sickness ("Yes" column) is considered. The over-all frequency of sickness was less than for either of the preceding groups and none reported being sick on trains. Air-sickness is included in this table. About 20% had been sick to some degree. (In this connection see Table 19, which shows small amounts of air experience for these men.)

Table 18 displays self-ratings of probable future sickness. Only boats were mentioned as possible causes of sickness by a significant number (17.7%). The pilots were either a self-selected group, so far as sickness susceptibility was concerned, or an optimistic group. It seems likely that both factors played a part.

Table 19 shows the amount of experience. Although an inland group, 72% had some sea experience as compared to 77% among the Wesleyan group. Inexperience was negligible on the other vehicles. This group showed a very high frequency of experience reports of "often" for auto rides, perhaps because airports are usually reached only by auto.

TABLE 17

Have you ever been:

	Yes	Slightly	No	N included in group
Seasick	12.4	15.8	71.7	145
Train sick	0	3.6	96.3	193
Car sick (street car or subway)	4.0	4.5	91.3	196
Car sick (autos)	7.6	8.6	83.6	196
Airsick	7.9	11.1	80.3	197
Average (not including airsick)	6.0	8.1	85.7	

TABLE 18

Under ordinary circumstances, under the stated conditions, I would (1) become very sick, to the point of nausea and vomiting, (2) become queasy, pale and feel uncomfortable, (3) be only slightly affected, (4) be unaffected.

	1	2	3	4
Four-hour sea voyage in moderate wind	0	2.0	17.7	80.2
Four-hour train trip	0	0	2.0	97.9
One-hour street car or subway ride	0	0	2.0	97.9
Four-hour auto trip as passenger	0	0	1.5	98.4
Average	0	0.5	5.8	93.6

TABLE 19

I have taken voyages or trips (1) often, (2) occasionally, (3) rarely, (4) never.

	1	2	3	4	No Answer
Sea	8.6	30.9	32.4	26.3	1.5
Train	49.7	32.4	15.2	2.0	0.5
Street car or subway	69.0	22.3	8.1	0.5	0
Auto	96.4	2.5	0.5	0.5	0
Airplane	38.0	37.0	19.2	4.5*	1.0
Average (not including airplane trips)	55.9	22.0	14.1	7.3	0.5

*These were accepted pilot applicants who had not yet had their first training flight.

Table 20 shows susceptibility at various age levels. The rank order of the four vehicles is the same as for the preceding student group, viz. boats, autos, cars, trains. The over-all frequency of susceptibility of these pilots as indicated in column 4 ("never susceptible") is less than for any of the preceding non-pilot groups. The general trend of results in relation to age is like that of the other groups, showing decreasing susceptibility with increasing age.

TABLE 20

I am or was susceptible to sickness (1) now, (2) during high school years, (3) during grade school years, (4) never, (5) insufficient experience.

	1	2	3	4	5	No Answer
On boats	2.0	2.5	7.1	60.4	26.9	1.0
On trains	0	1.0	2.0	90.8	4.5	1.5
On street cars or subways	0.5	0.5	6.5	90.3	1.5	0.5
In autos	1.5	0.5	7.6	85.7	4.0	0.5
Average	1.0	1.1	5.8	81.8	9.2	0.9

Table 21 shows reports on other devices. There are fewer reports of "no experience" than for the preceding groups and fewer reports of sickness.

TABLE 21

Indicate whether the following have, within the last four years, made you feel nauseated to some degree.

	Yes	No	No Experience
Elevator	5.5	93.9	0.5
Hammock	2.0	88.3	9.6
Lawn swing	5.5	88.9	5.5
Merry-go-round	4.0	86.8	9.1
Ferris wheel	2.0	87.8	10.1
Airplane glider	1.5	42.6	55.8
Loop-o-plane	4.0	50.7	45.1
Lindy-Loop	2.0	47.7	50.2
Roller coaster	4.0	85.7	9.1
The Whip	4.5	75.1	20.3
Average	3.6	77.7	21.5

5. United Air Lines stewardesses (N = 189). The questionnaire of January 14, 1941, was slightly different in format from that used on the preceding two groups, but in content differed in only two small points; namely, that it added a question on susceptibility during the pre-school period, and that it combined airplane gliders, loop-o-planes, etc. into one question instead of three as in the earlier questionnaire. This group was homogeneous with respect to training (nursing), occupation, age, and physical condition, but not with respect to origin. The results are displayed in Tables 22 to 26.

Table 22 shows actual sickness of those with experience. The rank order of vehicles in producing sickness, judged by frequency of "no" answers, was like preceding groups, being boats, autos, trains, and cars, the latter two being about equal. The rank orders of sickness are not changed when frank sickness ("yes" column) is the criterion. The over-all frequency of sickness is greater than for any of the preceding groups of male college students or pilots. Frequency of airsickness is not included in this table because the questions on it were put in a different form. Our earlier report showed that 42% had been airsick to the point of vomiting, 36% to lesser sickness, and 22% not sick. It would therefore appear that in the rank order of vehicles, planes take first place, ahead of boats.

TABLE 22

Have you ever been:

	Yes	Slightly	No	N included in Group
Seasick	22.0	17.0	61.0	100
Train sick	9.6	4.8	85.4	186
Car sick (street car or subway)	8.0	7.4	84.4	187
Car sick (autos)	18.0	11.1	70.7	188
Average	14.4	10.1	75.4	

Table 23 displays self-ratings of probable future sickness. Thirty-five per cent predicted that they would get sick to some degree on boats, while only 5% predicted sickness on trains, cars, and autos. The over-all prediction rates were similar to those of the college student groups.

Table 24 shows extent of experience. Rather few (2.6%) had frequent boat rides and about half had none. The frequency of complete lack of experience on other vehicles was insignificant. The group was similar to the pilot group in the high frequency of auto experience, but had somewhat less on trains.

TABLE 23

Under ordinary circumstances, under the stated conditions, I would (1) become very sick, to the point of nausea and vomiting, (2) become queazy, pale and feel uncomfortable, (3) be only slightly affected, (4) be unaffected.

	1	2	3	4	No Answer
Four-hour sea voyage in moderate wind	2.6	10.1	21.8	64.8	0.5
Four-hour train trip	0	1.0	4.2	94.7	0
One-hour street car or subway ride	0	0.5	4.7	94.7	0
Four-hour auto trip as passenger	0	2.1	2.6	95.2	0
Average	0.7	3.4	8.3	87.4	0.1

TABLE 24

I have taken voyages or trips (1) often, (2) occasionally, (3) rarely, (4) never.

	1	2	3	4	No Answer
Sea	2.6	14.8	35.1	46.8	0.5
Train	35.4	43.9	18.5	1.5	0.5
Street car or subway	72.4	21.6	4.7	1.0	0
Auto	96.2	2.3	1.0	0.5	0
Average	51.7	20.7	14.8	12.5	0.3

Table 25 shows susceptibility at various age levels. This questionnaire included a question on the pre-school period, like that used with the first Wesleyan student group. The subjects were allowed to check as many alternatives on these questions as applied to them. The trend of the results was the same as in the Wesleyan group, showing the greatest number of reports of susceptibility at grade school age, with subsequent decrease. As in the Wesleyan group, the pre-school period was less often reported as one of susceptibility.

Table 26 shows sickness on other devices. The frequencies are two to five times those reported by pilots, but not much different from those reported by male college students. The airsickness, like the pilots, mostly had experience on the devices.

TABLE 25

I am or was susceptible to sickness (1) now, (2) during high school years, (3) during grade school years, (4) during pre-school years, (5) never, (6) insufficient experience.

	1	2	3	4	5	6	No Answer
On boats	2.6	4.7	4.2	3.7	40.2	48.6	4.7
On trains	2.6	3.1	7.9	6.3	82.0	6.3	0.5
On street cars or subways	3.7	3.1	7.9	6.3	83.0	1.5	0
In autos	5.8	9.5	12.6	6.3	71.9	1.5	0
Average	3.7	5.1	8.2	5.7	69.3	14.5	1.3

TABLE 26

Indicate whether the following have, within the last four years, made you feel nauseated to some degree.

	Yes	No	No Experience	No Answer
Elevator	10.5	89.4	0	
Hammock	7.9	76.7	14.8	0.5
Lawn swing	13.2	79.8	6.8	
Merry-go-round	13.7	79.3	6.8	
Ferris wheel	11.1	81.4	7.3	
Roller coaster	10.0	80.9	8.9	
The Whip	15.3	69.3	14.2	1.0
Airplane glider, loop-o-plane, etc.	20.6	53.4	25.9	
Average	12.8	76.3	10.6	0.2

6. Brown University female students in psychology, spring of 1942 (N = 109). This group and the Brown and Harvard male student groups completed the December, 1941, form of the questionnaire. The first group of questions, concerning boats, autos, trains, cars and buses, combined questions asked in previous questionnaires. The second group covered miscellaneous devices. It allowed the student to report in either of two categories of sickness, rather than only one, as in the previous questionnaires. The obtained data are displayed in Tables 27 and 28. Columns 1 to 4 show the percentages of those with experience who chose each alternative. The percentages in Row 1 (boats) are based on 82 girls who had experience on boats; those in Row 2 (autos), on 108 girls with

TABLE 27

Below are listed five moving vehicles and carriers whose motion can produce nausea (seasickness, car sickness, etc.). Think back over your own experience with each of these and answer according to this scale: (1) am now somewhat subject to sickness, would probably vomit if the ride were long and rough, (2) used to be subject to sickness (a few years ago or as a child) but am not now subject to it, (3) have been somewhat subject to nausea, but not to the point of vomiting, (4) have never been affected by rides, (x) have not had enough experience to know whether I would be affected.

	1	2	3	4	x
Rides in boats (seasickness)	10.9	9.7	19.5	59.7	24.7
Rides as a passenger in autos (car sickness)	2.7	20.3	20.3	56.4	0.9
Rides in trains	0.9	2.8	9.6	86.5	4.5
Rides in street cars or subway trains	0.9	2.7	13.8	82.4	0.9
Rides in buses	3.6	2.7	25.9	67.5	0.9
Average	3.8	7.6	17.8	70.5	6.4

TABLE 28

Indicate in each case whether the device has made you feel nauseated during the last four years. Use the following scale: (1) I have been strongly nauseated (to the extent of vomiting or almost to it), (2) I have been slightly nauseated (felt queazy), (3) I have been unaffected, (x) have not had enough recent experience to know whether I would be affected.

	1	2	3	x
Elevator	1.8	35.7	62.3	0
Hammock	1.0	18.4	80.4	15.6
Lawn swing	3.1	17.7	79.1	11.9
Merry-go-round	1.9	21.7	76.2	7.3
Ferris wheel	7.4	29.6	62.9	25.6
Roller coaster	9.7	37.5	52.7	33.9
The Whip	9.6	28.9	61.4	23.8
Airplane glider, loop-o-plane, etc.	15.2	37.2	47.4	45.8
Airplane rides as a passenger	2.7	13.5	83.7	66.0
Average	5.8	26.7	67.3	25.5

experience in autos. In each table the "x" column gives the percentage of the total group which reported "insufficient experience" on each device and who were therefore not included in the other percentages.

Table 27 may best be evaluated by examining Column 4, chosen by those who "had never been affected by rides." This alternative is similar to the "no sickness" alternative reported in Tables 7, 12, 17, and 22. The rank order of effectiveness of vehicles in producing sickness was: autos, boats, buses, cars, and trains. This is the only one of the eight groups presented in this report in which boats did not stand in first place among these four vehicles. If Column 1 is examined ("now subject to sickness"), the rank order is: boats, buses, autos, and cars or trains. The over-all frequency of sickness was roughly comparable to that reported by the male college student groups on the other questionnaires. This should not be accepted as evidence of absence of sex differences in susceptibility, since the questionnaires were different. For comparison of the sexes, the data of the male Brown students and the Harvard students should be consulted.

The results shown in Table 28 cannot properly be compared to those of the other questionnaires except as to frequency of lack of sufficient experience. Lack of experience was similar in frequency to that found in the male college student groups. A comment may be made on airsickness. The reported frequency (16%) is below the pilots' 20% or stewardesses' 78%. It seems reasonable to assume that many had made only short hops and therefore had little opportunity for sickness.

7. Brown University male students in psychology, spring of 1942, (N = 293). The data are displayed in Tables 29 and 30. The "insufficient experience" columns (x) again are percentages of the total group; the other columns, percentages of those with experience.

Table 29 evaluated by Column 4 ("never affected") puts the vehicles in the order, boats, autos, buses, cars, trains. Only boats are placed in significant numbers in Column 1 ("now subject to sickness"). The over-all frequency of sickness is 8% below that of the female group from Brown University.

Table 30 may be compared with that for the women from Brown, Table 28. The men had less experience on merry-go-rounds, but more on roller coasters and airplanes. The over-all sickness rates were lower for the men than for the women.

8. Harvard college students, spring of 1942 (N = 245). The data are displayed in Tables 31 and 32. Table 31 shows the rank order of effectiveness of vehicles in producing sickness to be, boats, autos, buses, cars, and trains. This sequence is the same as for the Brown University men. Only boats appear significantly in Column 1. The frequency of inexperience is very nearly the same as for both Brown University groups. Over-all sickness rates were similar to the Brown men.

TABLE 29

Below are listed five moving vehicles and carriers whose motion can produce nausea (seasickness, car sickness, etc.). Think back over your own experience with each of these and answer according to this scale: (1) am now somewhat subject to sickness, would probably vomit if the ride were long and rough, (2) used to be subject to sickness (a few years ago or as a child) but am not now subject to it, (3) have been somewhat subject to nausea, but not to the point of vomiting, (4) have never been affected by rides, (x) have not had enough experience to know whether I would be affected.

	1	2	3	4	x
Rides in boats (seasickness)	13.6	5.9	20.4	60.0	24.8
Rides as a passenger in autos (car sickness)	0.3	18.4	7.8	73.3	0
Rides in trains	0	2.1	4.2	93.5	4.4
Rides in street cars or subway trains	0.4	4.7	7.5	87.6	0.6
Rides in buses	0.3	5.3	14.8	79.5	3.4
Average	2.9	7.3	10.9	78.8	6.6

TABLE 30

Indicate in each case whether the device has made you feel nauseated during the last four years. Use the following scale: (1) I have been strongly nauseated (to the extent of vomiting or almost to it), (2) I have been slightly nauseated (felt queazy), (3) I have been unaffected, (x) have not had enough recent experience to know whether I would be affected.

	1	2	3	x
Elevator	0	17.3	82.6	1.0
Hammock	1.1	14.2	84.6	11.2
Lawn swing	0.7	19.2	80.0	12.9
Merry-go-round	3.1	13.4	83.4	13.3
Ferris wheel	1.7	14.2	83.9	23.5
Roller coaster	3.4	25.5	71.0	18.9
The Whip	4.6	22.1	73.2	25.9
Airplane glider, loop-o-plane, etc.	7.2	27.6	65.1	47.9
Airplane rides as a passenger	0.7	9.1	90.0	55.6
Average	2.5	18.1	79.3	23.4

TABLE 31

Below are listed five moving vehicles and carriers whose motion can produce nausea (seasickness, car sickness, etc.). Think back over your own experience with each of these and answer according to this scale: (1) am now somewhat subject to sickness, would probably vomit if the ride were long and rough, (2) used to be subject to sickness (a few years ago or as a child) but am not now subject to it, (3) have been somewhat subject to nausea, but not to the point of vomiting, (4) have never been affected by rides, (x) have not had enough experience to know whether I would be affected.

	1	2	3	4	x
Rides in boats (seasickness)	22.5	7.6	28.5	41.2	25.6
Rides as a passenger in autos (car sickness)	2.0	19.7	10.2	67.9	0.8
Rides in trains	0.4	2.0	2.5	95.4	2.0
Rides in street cars or subway trains	0.4	4.9	2.0	93.0	0.8
Rides in buses	1.6	5.4	13.8	79.2	2.4
Average	5.4	7.9	11.4	75.3	6.3

TABLE 32

Indicate in each case whether the device has made you feel nauseated during the last four years. Use the following scale: (1) I have been strongly nauseated (to the extent of vomiting or almost to it), (2) I have been slightly nauseated (felt queasy), (3) I have been unaffected, (x) have not had enough recent experience to know whether I would be affected.

	1	2	3	x
Elevator	0	17.6	82.3	0.8
Hammock	0.9	15.2	84.2	22.0
Lawn Swing	1.5	18.2	80.2	21.6
Merry-go-round	1.5	17.5	80.9	20.0
Ferris wheel	1.8	12.6	85.4	35.5
Roller coaster	2.2	22.6	75.1	27.7
The Whip	5.5	23.6	70.8	34.0
Airplane glider, loop-o-plane, etc.	9.2	22.6	68.0	51.4
Airplane rides as a passenger	11.0	13.7	75.2	55.5
Average	3.7	18.2	78.0	29.8

Table 32 shows that the over-all sickness rates on miscellaneous devices were almost identical with those of the Brown men, except for airplanes, on which only 10% of the Brown men had reported sickness, while 25% of the Harvard men did. The Harvard men reported less experience than did the Brown men on all devices except elevators and airplanes.

SOME OVER-ALL RESULTS

The basic data which appear in Tables 1 to 32 may be rearranged in a variety of instructive combinations. In the interests of space-saving, only two will be presented here: (1) the frequency of reports of non-susceptibility on various vehicles and as determined by various ways of phrasing in the questionnaires, and (2) the frequency of reports of experience or lack of experience on various vehicles and as affected by various ways of phrasing the questions. For the purposes of these over-all comparisons each group of subjects is treated as equivalent to each other group, with no attention to size of group, sex or selection.

1. Frequency of Non-Susceptibility. Table 33 shows the over-all percentages of people who reported non-susceptibility in four different forms of questions. Each row in the table summarizes data on one question form. The rows are as follows: A -- reported that under ordinary circumstances they "would be unaffected by a voyage or trip"; B -- said "No" to a question on whether they had ever been sick; C -- reported that they had "never" been susceptible at any age levels and D -- reported that they had "never been affected" by trips. The percentages in each cell are averages of the frequencies of all groups who answered that question, taking no account of group size or composition. Two analyses can be made, the effect of type of vehicle and the effect of form of question.[5]

Non-susceptibility is least frequent on boats and next least frequent in autos. Cars and trains show the highest frequencies of resistance to sickness, being well above either autos or boats; but in no case is there a large difference between them.

The form of the question has some influence on reported frequencies. We may consider first the last column showing average frequencies. According to this, the lowest frequency of resistance to sickness appears in Row C which summarizes the cases who reported that at no age level had they ever been "susceptible." The Row D is only slightly larger and is based on a similar set of questions on the short-form questionnaire, the subject being asked to state that at no stage of his life was he susceptible. Row B yields the next largest frequency. It is based on a question answered by those who had never actually been sick; i.e., it called for a report on actual instances rather than a judgment of "susceptibility." The highest frequency of non-susceptibility (Row A) is found when they rate themselves on probable future sickness. If we consider the effect of question-form on replies relating to each vehicle, we see that Row A

[5] Results found in Tables 2 and 4 are not included in Table 33.

TABLE 33

PERCENTAGE FREQUENCY OF NON-SUSCEPTIBLES ACCORDING TO FOUR FORMS OF QUESTIONNAIRE PHRASING

Row	Tables from which data were taken	Per cent of Subjects Not Affected by Each Vehicle: Boats	Trains	Cars	Autos	Buses	Average
A	Column 4, Tables 8, 13, 18, 23	69.4	92.3	94.9	91.0		86.9
B	"No" column, Tables 7, 12, 17, 22, 24	63.8	89.9	86.6	74.0		78.6
C	"Never" column, Tables 5, 10, 15, 20, 25	47.3	86.0	85.7	74.7		73.4
D	"Never" column, Tables 27, 29, 31.	53.6	91.6	87.7	65.9	(75.4)*	74.7
	Average	58.5	89.9	88.7	76.4		

*Not included in average.

shows the largest percentage of reports of non-susceptibility on each of the four vehicles. There is variation, however, in the ranks of the three other question-forms, depending upon the vehicle.

2. Frequency of experience. The effectiveness of such questionnaires as predictive instruments depends in part on the amount of experience subjects have had with boats, trains, cars, autos, etc. The greater the amount of experience, the more opportunities there are to get a rating of susceptibility. Our questionnaires called for reports on experience by means of four types of questions. Some over-all results are shown below and in Table 34.

The average frequency of subjects who reported, "I have taken voyages or trips often" and those who reported "never" are as follows:

	"Often"	"Never"
Boats	8.9%	30.2%
Trains	48.3%	1.6%
Cars	66.2%	0.8%
Autos	92.8%	0.3%

The first individuals are presumably those best in a position to be rated for susceptibility; the latter can be rated only indirectly. The data are from Columns 1 and 4 of Tables 3, 9, 14, 19, and 24; Columns 2, 3, and 5 are omitted from this summary. It is readily seen that when all the data included in these five groups are taken together, only autos

were used "often" by most subjects; few were "often" on boats. Boats are the only vehicles with which a significant number had no experience at all.

Table 34 shows frequencies of reports of lack of sufficient experience, according to two question-forms. Only with reference to boats did a significant percentage of subjects rate themselves as having insufficient experience to judge their own susceptibility. As might be expected, autos are at the other extreme. It should be pointed out that there is no basis for attributing these differences in frequency of response to the form of the question; it may be a difference among the groups who took each form of question.

TABLE 34

PERCENTAGE FREQUENCY OF REPORTS OF "INSUFFICIENT EXPERIENCE" ACCORDING TO TWO FORMS OF QUESTIONNAIRE PHRASING

	Boats	Trains	Cars	Autos	Buses	Average
Tables 5, 10, 15, 20, 25	35.4	5.4	3.1	2.1		11.5
Tables 27, 29, 31	25.0	3.6	0.8	0.6	(2.2)*	7.7
Average	30.2	4.5	2.0	1.4		

*Not included in average.

Frequency of Susceptibility to Motion Sickness
Among Young Adults

I

APPENDIX A

QUESTIONNAIRES

Appendix A-1: Sea, Train, Car, Airsickness Questionnaire, February, 1940
Appendix A-2: Experimental Questionnaire Form, June, 1940
Appendix A-3: Experimental Questionnaire Form, January 14, 1941
Appendix A-4: Motion-Sickness Inventory, December, 1941

APPENDIX A-1

SEA, TRAIN, CAR, AIRSICKNESS QUESTIONNAIRE
February, 1940

NAME AND INITIALS _____

This questionnaire will take from 5 to 10 minutes of your time. We hope you can fill it out for us.

Part of our purpose in distributing the questionnaire is the selection of subjects for our experiments. We shall be very grateful if you are willing to be a subject. However, please fill in the questionnaire even though you are not willing to be a subject, since the data thus secured will be of value to us.

The questionnaire deals mainly with your susceptibility to seasickness, car sickness, airsickness, etc. We want to find out how many people are susceptible, what kind of people are susceptible, under what conditions they become ill, and what can be done to prevent it.

Please answer the questions below as accurately as possible. THINK CAREFULLY ABOUT EACH QUESTION BEFORE ANSWERING IT. Please answer every question.

I.

Place an "X" at the proper answers.

A. Under ordinary circumstances, if I were to make a sea voyage of four hours' duration during a moderate wind, I predict that I would:

1. Become very seasick, to the point of nausea and vomiting
2. Become queasy, pale, and feel very uncomfortable
3. Be only slightly affected by the voyage
4. Be unaffected by the voyage
x. Could not predict because of lack of recent experience

B. I have taken sea voyages:

Often_____; Occasionally_____; Rarely_____; Never_____;
Some years ago_____; Recently_____

C. In the recent past I have become seasick

1. Usually
2. Sometimes
3. Rarely
4. Not at all
x. Insufficient experience

D. I am or was susceptible to train sickness (mark all that are correct):

1. Now
2. During high school years
3. During grade school years
4. During pre-school years
5. Never, to my knowledge
x. Insufficient experience to make a judgment

II.

E. Under ordinary circumstances, if I were to make a train trip of four hours' duration, I predict that I would:

1. Become very ill to the point of vomiting
2. Become queasy, pale, and feel very uncomfortable
3. Be slightly affected by the trip
4. Be completely unaffected by the trip
x. Could not predict because of lack of experience

F. I have taken train trips:

Often_____; Occasionally_____; Rarely_____; Never_____;
Some years ago_____; Recently_____

G. In the recent past I have become train sick:

1. Usually
2. Sometimes
3. Rarely
4. Not at all
x. Insufficient experience

H. I am or was susceptible to train sickness:

1. Now
2. During high school years
3. During grade school years
4. During pre-school years
5. Never, to my knowledge
x. Insufficient experience to make a judgment

III.

I. Under ordinary circumstances, if I were to take a street car ride of one hour's duration, I predict that I would:

1. Become very ill to the point of vomiting
2. Become queasy, pale, and feel very uncomfortable
3. Be slightly affected by the ride
4. Be completely unaffected by the ride
x. Could not predict because of lack of experience

J. I have taken street car rides:

Often_____; Occasionally_____; Rarely_____; Never_____;
Some years ago_____; Recently_____

K. In the recent past I have become street car sick:

1. Usually
2. Sometimes
3. Rarely
4. Not at all
x. Insufficient experience

L. I am or was susceptible to street car sickness:

1. Now
2. During high school years
3. During grade school years
4. During pre-school years
5. Never, to my knowledge
x. Insufficient experience to make a judgment

IV.

M. Under ordinary circumstances, if I were to make an automobile trip of four hours duration (as a passenger), I predict that I would:

1. Become very ill to the point of vomiting
2. Become queasy, pale, and feel very uncomfortable
3. Be slightly affected by the ride
4. Be completely unaffected by the ride
x. Could not predict because of lack of experience

N. I have taken automobile rides as a passenger:

Often_____; Occasionally_____; Rarely_____; Never_____;
Some years ago_____; Recently_____

O. In the recent past I have become car sick when riding as a passenger in an automobile:

1. Usually
2. Sometimes
3. Rarely
4. Not at all
x. Insufficient experience

P. I am or was susceptible to car sickness when riding as a passenger in an automobile:

1. Now
2. During high school years
3. During grade school years
4. During pre-school years
5. Never, to my knowledge
x. Insufficient experience to make a judgment

V.

Q. Under ordinary circumstances, if I were to make a plane trip of three hours' duration in moderately rough air, I predict that I would:

1. Become very ill to the point of vomiting
2. Become queasy, pale, and feel very uncomfortable
3. Be slightly affected by the flight
4. Be completely unaffected by the flight
x. I have never flown in a plane
y. Insufficient experience for prediction

R. I have made plane trips:

Often_____; Occasionally_____; Rarely_____; Never_____; Recently_____;
Some years ago_____; As pilot_____; As passenger_____

VI.

In the following list indicate any situations which have within about the <u>last two years</u> made you feel nauseated to some degree.

S. 1. Motion pictures: Yes_____; No_____; No experience_____
2. Driving past trees through which the sun flickers:
Yes_____; No_____; No experience_____

T. 1. Merry-go-round: Yes_____; No_____; No experience_____
2. Ferris wheel: Yes_____; No_____; No experience_____
3. Airplane glider: Yes_____; No_____; No experience_____
4. Elevator: Yes_____; No_____; No experience_____
5. Loop-o-plane: Yes_____; No_____; No experience_____
6. Lindy-loop: Yes_____; No_____; No experience_____
7. Roller coaster: Yes_____; No_____; No experience_____
8. The Whip: Yes_____; No_____; No experience_____

VII.

U. My college class is

Freshman_____; Sophomore_____; Junior_____; Senior_____

V. Height (without shoes)_____ Weight unclothed_____

W. Age: years_____ months_____

Compiled by G. H. Wendt

APPENDIX A-2

EXPERIMENTAL QUESTIONNAIRE FORM
June, 1940

The following sheets contain a questionnaire designed to discover the interrelationship of a number of physical, physiological, and psychological traits which may have some relationship to airplane flying capacity. We are asking you to fill it out so that we may eventually be able to develop standards for the selection of pilots. This present questionnaire is not a test. You will be given no 'score' on it, nor will the results be used for any purposes other than those of this experiment. In order for your paper to be of value to us, it is necessary that you cooperate in three ways.

1. We must have answers that are honest and accurate. Answer in accordance with your best judgment of the truth rather than with what you think you would like the answer to be, or with exaggerated answers. Do not quibble over some special interpretation of your own in the case of individual items.

2. Leave no item blank. Blanks on your paper may spoil it for our uses. Even though you may feel that particular items are of no importance, or are too personal, accept our assurance that we would not have included them had they not seemed important.

3. Return this questionnaire promptly. Our staff is hired for a limited period, so we must ask for your immediate attention.

Do not discuss your answers with others. We want your judgment, not that of your friends.

G. R. Wendt, Chairman
Department of Psychology

1. Sex: Male_____ Female_____

2. Age: Years_____ Months_____

3. Height (without shoes)_____

4. Weight (unclothed)_____

5a. Are you a college student? Yes_____ No_____
b. If you are in college, what class will you be in next fall?
Freshman_____; Sophomore_____; Junior_____; Senior_____; Special_____; Graduate_____

6. Why are you in summer school? (a) Work during year prevents attendance at regular session_____; (b) Failure or low grades in course during regular session_____; (c) Illness during regular session_____; (d) Desire to speed up rate of education_____; (e) State teachers' requirement_____; (f) Other (specify)_____

7. Are you a CAA student pilot? Yes_____ No_____

8. Have you been a CAA student pilot? Yes_____ No_____

9. Do you intend to be a CAA student pilot? Yes_____ No_____

10. At what college are you taking this questionnaire?_____

11. What community and state is your home in? Town_____
State_____

Please answer the questions below as accurately as possible.
THINK CAREFULLY ABOUT EACH QUESTION BEFORE ANSWERING IT.

Place an "X" at the proper answers.

12. Have you ever been seasick? a. Yes_____ b. No_____ c. Slightly_____
Under what circumstances?

13. Under ordinary circumstances, if I were to make a sea voyage of four hours' duration during a moderate wind, I predict that I would:

a. Become very seasick, to the point of nausea and vomiting
b. Become queasy, pale, and feel uncomfortable
c. Be only slightly affected by the voyage
d. Be unaffected by the voyage

14. I have taken sea voyages:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

15. In the last four years I have become seasick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by boat

16. I am, or was, susceptible to seasickness (mark as many as are correct):

a. Now_____; b. During high school years_____; c. During grade school years_____; d. Never, to my knowledge_____; e. Insufficient experience to make a judgment_____

17. Have you ever been train sick? a. Yes_____ b. No_____ c. Slightly_____
Under what circumstances?

18. Under ordinary circumstances, if I were to make a train trip of four hours' duration, I predict that I would:

a. Become very sick, to the point of nausea and vomiting
b. Become queasy, pale, and feel uncomfortable
c. Be only slightly affected by the trip
d. Be unaffected by the trip

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

20. In the last four years I have become train sick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by train.

21. I am, or was, susceptible to train sickness (mark as many as are correct):

a. Now_____; b. During high school years_____; c. During grade school years_____; d. Never, to my knowledge_____; e. Insufficient experience to make a judgment_____

22. Have you ever been car sick in a street car or subway train?

a. Yes_____; b. No_____; c. Slightly_____ Under what circumstances?

23. Under ordinary circumstances, if I were to take a street car or subway ride of one hour's duration, I predict that I would:

a. Become very sick, to the point of nausea and vomiting
b. Become queasy, pale, and feel uncomfortable
c. Be only slightly affected by the trip
d. Be unaffected by the trip

24. I have taken street car or subway rides:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

25. In the last four years I have become street car sick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by street car or subway.

26. I am, or was, susceptible to street car sickness:

a. Now_____; b. During high school years_____; c. During grade school years_____; d. Never, to my knowledge_____; e. Insufficient experience to make a judgment_____

27. Have you ever been car-sick in an automobile? a. Yes_____; b. No_____; c. Slightly_____ Under what circumstances?

28. Under ordinary circumstances, if I were to make an automobile trip of four hours' duration (as a passenger) I predict that I would:

a. Become very sick, to the point of nausea and vomiting
b. Become queasy, pale, and feel uncomfortable
c. Be only slightly affected by the trip
d. Be unaffected by the trip

29. I have taken auto rides as a passenger:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

30. In the last four years I have become car sick when riding as a passenger:

a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; on those occasions when I travelled by automobile

31. I am, or was, susceptible to car sickness when riding as a passenger:

a. Now_____; b. During high school years_____; c. During grade school years_____; d. Never, to my knowledge_____; e. Insufficient experience to make a judgment_____

32. Have you ever been airsick during a plane ride? a. Yes_____ b. No_____ c. Slightly_____

33. I have made plane trips:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last year_____; b. More than a year ago_____
III. a. As pilot_____; b. As passenger_____

34. Indicate whether the following have, within the last four years, made you feel nauseated to some degree (please be sure to check somewhere after each one).

Device	Yes	No	No Experience
a. Elevator	_____	_____	_____
b. Hammock	_____	_____	_____
c. Lawn swing	_____	_____	_____
d. Merry-go-round	_____	_____	_____
e. Ferris wheel	_____	_____	_____
f. Airplane glider	_____	_____	_____
g. Loop-o-plane	_____	_____	_____
h. Lindy-loop	_____	_____	_____
i. Roller coaster	_____	_____	_____
j. The Whip	_____	_____	_____

35. Do you wear glasses? a. No_____; b. For close work only_____; c. For distant work only_____; d. For both_____

36. Do you feel any eye discomfort from reading for a period as long as three hours? a. A great deal_____; b. Some_____; c. None_____

37. Estimate the total number of times per year that you attend movies_____

38. On a bright summer day do you have discomfort unless you wear smoked glasses? a. Considerable_____; b. Slight_____; c. None_____

39. So far as you know, is your hearing unimpaired? a. Yes_____ b. No_____

40. If impaired, is this true of: a. One ear_____; b. Both ears_____

41. Have you, to your knowledge, ever had running ears? a. Yes___ b. No___

42. Have you ever had a mastoid operation? a. Yes_____ b. _____

43. Do you often have dizzy spells? a. Yes_____ b. No_____ c. ?_____

44. Do you often have buzzing or ringing noises in your ears? a. Yes_____ b. No_____ c. ?_____

45. Does it bother you to stand on a high place and look down? a. Yes_____ b. No_____ c. ?_____

46. Is your general state of health usually: a. Excellent_____ b. Good_____ c. Fair_____ d. Poor_____ e. Very poor_____

47. Have you had (check):

a. Hives
b. Hay fever
c. Rose fever
d. Asthma
e. Frequent colds
f. Ivy or oak poisoning
g. Other allergies (specify)

48. Do you have headaches: a. Often_____; b. Occasionally_____; c. Rarely___

49. Have you ever had jaundice? a. Yes_____; b. No_____

50. Do you have a coated tongue? a. Often_____; b. Occasionally_____; c. Rarely_____

51. Do you have halitosis? a. Often_____; b. Occasionally_____; c. Rarely _____; d. Never_____

52. Are you bothered by gas in the stomach or intestines? a. Often_____; b. Occasionally_____; c. Rarely_____

53. Are you subject to attacks of indigestion? a. Often_____; b. Occasionally_____; c. Rarely_____

54. Are your bowel movements: a. Very regular_____; b. Somewhat irregular_____; c. Very irregular_____

55. Do you have diarrhea or watery stools (check the closest one): a. Almost never_____; b. Once or twice a year_____; c. Ten or twelve times a year_____; d. Three or four times a month_____; e. Chronically_____

56. Do you have constipation? a. [illegible] never____; b. Once or twice a year____; c. Ten or twelve times a year____; d. Three or four times a month____; e. Chronically____

57. Do you have attacks of nausea? a. Often____; b. Occasionally____; c. Rarely____

58. Do headaches nauseate you? a. Extremely____; b. Slightly____; c. No____

59. Do you vomit when you have a fever? a. Usually____; b. Occasionally ____; c. Rarely____; d. Never____

60. Do you lose your appetite if you miss meal-time? a. Feel very little like eating____; b. Am sometimes affected____; c. No____

61. Do you feel nauseated if you become very fatigued? a. Often____; Occasionally____; c. Never____

62. Would it spoil your appetite if you ate in a restaurant which did not smell clean? a. Yes____; b. No____; c. ?____

63. Does it seriously affect your appetite if food is unattractively served? a. Yes____; b. No____; c. ?____

64. Would it affect your appetite if someone told a disgusting story at meal-time? a. Yes____; b. No____; c. ?____

65. Do you gag easily and violently when a physician presses against the back of your tongue with a tongue blade? a. Yes____; b. No____; c. ?____

66. Have you within the last two years, had any tendency to feel nauseated as a result of attending a movie? a. Yes____; b. Slightly____; c. No____

67. Have you had any tendency to feel nauseated when driving past trees through which the sun flickers? a. Yes____; b. Slightly____; c. No____

68. Do you often have a momentary "blacking out" when you rise suddenly from a sitting position? a. Often____; b. Occasionally____; c. Rarely____; d. Never____

69. Have you ever fainted? a. Yes____; b. Almost____; c. No____

70. If so, indicate below what the circumstances were and how often it has happened.

71. Do you get a severe pain in the side after running? a. Often____; b. Occasionally____; c. Rarely____

72. Do you have any sort of deficiency of your heart? a. Severe_____; b. Slight_____; c. None_____

73. Are you bothered by insomnia? a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____

74. Are you, or were you, a "finger-nail biter"? a. As a child_____; b. Now_____; c. Never_____

75. At what age did you begin smoking regularly?

a. I don't smoke regularly
b. Primary school
c. High school
d. Since high school

76. Do you usually drink coffee every day? a. Yes_____; b. No_____

77. Do you use alcohol? a. Considerable_____; b. Moderately_____; c. Occasionally_____; d. Rarely_____; e. Never_____

78. Do thunderstorms make you uneasy? a. Yes_____; b. No_____; c. ?_____

79. Does the sudden ringing of a class bell, door bell, or telephone startle you? a. Yes_____; b. No_____; c. Rarely_____

80. Do loud automobile horns annoy you? a. Yes_____; b. No_____; c. ?_____

81. Do you dislike to hear a person laughing loudly? a. Yes_____; b. No_____; c. ?_____

82. Do grating noises as of a finger-nail scratching on a black-board bother you? a. Yes_____; b. No_____; c. ?_____

83. Does it startle you to have someone unexpectedly slap you on the back? a. Yes_____; b. No_____; c. ?_____

84. Does it usually startle you suddenly to meet a person in the dark? a. Yes_____; b. No_____; c. ?_____

85. What is your religion?_____

86. What is your race?_____

87. What is the national origin of parents?_____

88. Is your family: a. Wealthy_____; b. Well-to-do_____; c. Comfortable _____; d. Average_____; e. Below average_____; f. Poor_____

89. Check as many of the following as are necessary to indicate your position in your family:

a. Only child
b. Only son
c. Oldest child
d. Youngest child
e. How many children in your family_____?

90. Are your own parents: a. Living together_____; b. Separated_____; c. Divorced_____; d. One dead_____; e. Both dead_____; f. Remarried_____

91. Do you consider that you had a normal childhood? a. Yes_____; b. No _____; c.?_____

Draw a small circle around the correct answer.

92. Yes No ? Did you ever have a strong desire to run away from home?

93. Yes No ? Was either of your parents very easily irritated?

94. Yes No ? Do you cry in the movies?

95. Yes No ? Do you consider that you are the kind of person who analyses his own emotions more than others do?

96. Yes No ? Do you usually try to avoid arguments?

97. Yes No ? Have you ever tried to argue or bluff your way past a guard or doorman?

98. Yes No ? If you are dining out, do you prefer to have someone else order dinner for you?

99. Yes No ? If you are one among several who have witnessed an accident, would you quickly take an active part in giving aid?

100. Yes No ? Do you ever complain to the waiter when you are served inferior food or have gotten poor service?

101. Yes No ? If a woman in front of you in the movies failed to remove her hat, would you make yourself uncomfortable rather than ask her to remove it?

102. Yes No ? Do you feel sure that you will succeed in life?

103. Yes No ? Are you able to play your best in a game against an opponent who is greatly superior to you?

104. Yes No ? Are you troubled with feelings of inferiority?

105. Yes No ? Do you tend to keep in the background at social functions?

106. Yes No ? Are you troubled with chimeras?

107. Yes No ? Do you feel that you are above the average in self-confidence?

108. Yes No ? Does admiration gratify you more than achievement?

109. Yes No ? Would you enjoy going on a youth hostel trip?

110. Yes No ? Would you dislike any work which might take you into isolation for a few years, such as forest ranging, etc.?

111. Yes No ? Are you extremely fond of symphony concerts?

Put an "X" before your choice.

112. Would you think it more valuable for a college to inaugurate

a. Compulsory chapel attendance
b. A compulsory course in Civics

113. When you pick up a Sunday paper, are you more likely to be interested in:

a. What the "Business Index" is doing
b. An article dealing with resolutions passed at the annual meeting of the Protestant Churches of America

114. Would you rather become a successful man by being:

a. The composer of a great symphony
b. A U. S. Senator

115. The country would be better off if the great wealth of a few were taxed out of existence.

a. Yes
b. No

116. While waiting in an office, would you be more likely to choose for reading:

a. The business magazine "Fortune"
b. "House and Garden"

117. If you had to choose a college science course, and assuming that the teachers were equally good, and that there was no specific requirement for your future career, would you choose:

a. Chemistry
b. Astronomy

118. Would you rather take a college course in:

a. Mathematics
b. Government

119. Would you prefer to see more active financial support by the government for:

a. Music and art projects
b. Historical studies of the economic and social development of cities

120. Would you rather attend at a World's Fair:

a. A collection of very famous religious relics such as the "Holy Grail," etc.
b. An exhibit of the "Magna Charta"

121. When you go to church, do you prefer to have the sermon emphasize

a. Current events
b. Abiding moral and religious values

122. If you were to become a teacher, assuming that you were equally expert, would you choose:

a. Economics
b. Philosophy

123. Do you think that you have a tendency to choose your friends from among:

a. Introverts
b. Extroverts

124. Would you prefer to write a theme for an English course on:

a. What is wrong with American education
b. What is wrong with business in our community

125. If you had your choice of attending one of two lectures, would you rather attend a lecture on:

a. Architecture of Greek temples
b. Governmental forms in ancient Rome

126. Assuming that you had equal ability, would you prefer to be a member of:

a. A college glee club
b. A college debating team

127. Do you think that our primary schools would benefit more from an increase of instruction in:

a. Art and music
b. Etiquette and social usage

128. If you were a college administrator faced with a cut in funds, would you prefer to discharge

a. An instructor in public speaking
b. An instructor in philosophy

129. On a visit to a museum would you be more likely to prefer a gallery

a. Of exhibits in science and industry
b. Of modern paintings

130. If you had a Sunday to spend on a brief trip, would you prefer to go to:

a. A rural region of scenic beauty
b. A park where there were amusement devices

131. Would you prefer to spend a half-hour of social conversation with:

a. An insurance salesman
b. A clergyman

132. Would you prefer to be invited to the home of:

a. A professor of psychology
b. A professor of economics

133. In an evening discussion with friends would you be more likely to want to discuss:

a. Problems of social betterment
b. Problems of economic betterment

134. Would you prefer that the governor of your state be

a. A college president of known administrative ability
b. The successful head of a large industry

135. Do you think that Boy Scout training should put the greater emphasis on:

a. Kindness to children, aged, or poor
b. Physical courage in meeting problems

136. Assuming that you had equal ability, which of each of the following alternatives would you prefer to become:

I. a. Business man
   b. Scientist

II. a. Social worker
    b. Political worker

III. a. Salesman
     b. Clergyman

IV. a. Race-horse breeder
    b. Sculptor

V. a. A great moral or spiritual influence
   b. A person with political and economic power

137. Have you ever studied in college, or do you believe that you intend to study:

I. Art
   a. Yes
   b. No

II. Astronomy
    a. Yes
    b. No

III. Greek or Latin
     a. Yes
     b. No

IV. Ethics or Religion
    a. Yes
    b. No

V. Geology
   a. Yes
   b. No

VI. Music
    a. Yes
    b. No

VII. Mathematics beyond elementary
     a. Yes
     b. No

VIII. Philosophy
      a. Yes
      b. No

138. Check one space after each

Activity	I am good enough to be team material	Have fair proficiency	Have engaged in it	Have not engaged in it sufficiently often to learn it
a. Handball	____	____	____	____
b. Touch football	____	____	____	____
c. Wrestling	____	____	____	____
d. Boxing	____	____	____	____
e. Volley ball	____	____	____	____
f. Basketball	____	____	____	____
g. Football	____	____	____	____
h. Cross-country	____	____	____	____
i. Horse-shoe throwing	____	____	____	____
j. Tennis	____	____	____	____
k. Golf	____	____	____	____
l. Baseball	____	____	____	____
m. Swimming	____	____	____	____

139. If you are a regular college student, list below the freshman team sports you competed in, if any. (If none, state this)

a.
b.
c.
d.

140. If you are a regular college student, list below the varsity team sports you competed in, if any. (If none, state this.)

a.
b.
c.
d.

141. As a student, are you:

a. Among the top 1%
b. Superior - top 7%
c. Above average - top 33%
d. Average - middle 34%
e. Below average - lower 33%
f. Inferior - bottom 7%
g. Among lowest 1%

Please check back over your paper to make sure that you have left no blank items or blank pages.

NAME:_____

HOME ADDRESS:_____

_____

(We should like your name and address so that we can, if necessary, ask you for further medical or psychological information. If you have any reluctance about giving it, leave this space blank.)

COMMENTS:

Compiled by G. R. Wendt .

EXPERIMENTAL QUESTIONNAIRE
January 14, 1941

The following sheets contain questions designed to discover the significance of certain facts in your experience on moving vehicles as indicators of susceptibility to airsickness. The questionnaire is not intended to be a test of you. The results will be used only for scientific purposes, not for rating purposes. In order that this study may be of value to us, it is necessary that you cooperate in three ways.

1. We must have answers that are honest and accurate. Answer in accordance with your best judgment of the truth rather than with what you would like the answer to be, or with exaggerated answers.

2. Leave no item blank. Blanks on your paper will spoil it for our purposes.

3. Return the questionnaire promptly.

* *

Name_____, _____, _____
last first initial

Sex Male____ Female____ Age ____ ____
years mos.

What classification of fliers are you in (CPT primary student, instructor, stewardess, civil airline pilot, etc.)? Identify yourself fully below.

_____

How many hours have you been in the air:
As a pilot or in being trained for piloting?_____.
When not piloting or not being trained for piloting?_____.

If you have had pilot training, how many hours had you been in the air as a passenger or in some other non-pilot capacity before you began your primary training for piloting?_____.

Please answer the questions below as accurately as possible.

THINK CAREFULLY ABOUT EACH QUESTION BEFORE ANSWERING IT.

Place an "X" at the proper answers.

1. Have you ever been seasick? a. Yes____; b. No____; c. Slightly____;
Under what circumstances?

2. Under ordinary circumstances, if I were to make a sea voyage of four hours' duration during a moderate wind, I predict that I would:

_____Become very seasick, to the point of nausea and vomiting
_____Become queasy, pale, and feel uncomfortable
_____Be only slightly affected by the voyage
_____Be unaffected by the voyage

3. I have taken sea voyages:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

4. In the last four years I have become seasick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by boat_____

5. I am, or was, susceptible to seasickness (mark as many as are correct):

a. Now_____; b. During high school years_____; c. During grade school years_____; d. During pre-school years_____; e. Never to my knowledge _____; f. Insufficient experience to make a judgment_____

****

6. Have you ever been train sick? a. Yes_____; b. No_____; c. Slightly _____ Under what circumstances?

7. Under ordinary circumstances, if I were to make a train trip of four hours' duration, I predict that I would:

_____Become very sick, to the point of nausea and vomiting
_____Become queasy, pale, and feel uncomfortable
_____Be only slightly affected by the trip
_____Be unaffected by the trip

8. I have taken train trips:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

9. In the last four years I have become train sick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by train.

10. I am, or was, susceptible to train sickness (mark as many as are correct):

a. Now_____; b. During high school years_____; c. During grade school years_____; d. During pre-school years_____; e. Never, to my knowledge _____; f. Insufficient experience to make a judgment

****

11. Have you ever been car sick in a street car or subway train?

a. Yes_____; b. No_____; c. Slightly_____ Under what circumstances?

12. Under ordinary circumstances, if I were to take a street car or subway ride of one hour's duration, I predict that I would:

_____Become very sick, to the point of nausea and vomiting
_____Become queasy, pale, and feel uncomfortable
_____Be only slightly affected by the trip
_____Be unaffected by the trip

13. I have taken street car or subway rides:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

14. In the last four years I have become street car sick: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by street car or subway_____

15. I am, or was, susceptible to street car sickness:

a. Now_____; b. During high school years_____; c. During grade school years_____; d. During pre-school years_____; e. Never, to my knowledge _____; f. Insufficient experience to make a judgment_____

****

16. Have you ever been car sick in an automobile? a. Yes_____; b. No_____; c. Slightly_____. Under what circumstances?

17. Under ordinary circumstances, if I were to make an automobile trip of four hours' duration (as a passenger) I predict that I would

_____Become very sick, to the point of nausea and vomiting
_____Become queasy, pale, and feel uncomfortable
_____Be only slightly affected by the trip
_____Be unaffected by the trip

18. I have taken auto rides as a passenger:

I. a. Often_____; b. Occasionally_____; c. Rarely_____; d. Never_____
II. a. Within the last two years_____; b. More than two years ago_____

19. In the last four years I have become car sick when riding as a passenger: a. Usually_____; b. Sometimes_____; c. Rarely_____; d. Not at all_____; On those occasions when I travelled by automobile_____

20. I am, or was, susceptible to car sickness when riding as a passenger

a. Now_____; b. During high school years_____; c. During grade school years_____; d. During pre-school years_____; e. Never, to my knowledge _____; f. Insufficient experience to make a judgment_____

****

21. Indicate whether the following have, within the last four years, made you feel nauseated to some degree (please be sure to check somewhere after each one).

Device	Yes	No	No Experience
a. Elevator	____	____	____
b. Hammock	____	____	____
c. Lawn swing	____	____	____
d. Merry-go-round	____	____	____
e. Ferris wheel	____	____	____
f. Roller coaster	____	____	____
g. The Whip	____	____	____
h. Airplane glider, loop-o-plane, etc.	____	____	____

****

22. Have you ever been airsick during a plane ride? How often? Write in numbers

_____a) To the point of vomiting and great muscular weakness
_____b) To the point of vomiting without severe and continued muscular weakness
_____c) To the point of sweating, pallor, feelings of nausea, and some muscular weakness
_____d) Only to the extent of feeling sleepy, slightly weak, restless, and "queasy"
_____e) Very short-lived feelings of nausea which come on during certain violent maneuvers and pass off promptly
_____f) To no degree whatever under any circumstances

23. In the performance of your present ordinary duties in the air, (whether these be as passenger, stewardess, student pilot, instructor, or others), do you become airsick to some degree? Use x's.

a) To the point of vomiting and great muscular weakness
_____ More than half of the time you fly
_____ Between 10% and 50% of the time you fly
_____ Once out of 10 flights to once in 30 flights
_____ Less than once in 30 times
_____ Never

b) To the point of vomiting without severe and continued muscular weakness
_____ More than half of the time you fly
_____ Between 10% and 50% of the time you fly
_____ Once out of 10 flights to once in 30 flights
_____ Less than once in 30 times
_____ Never

c) To the point of sweating, pallor, feelings of nausea, and some muscular weakness
_____ More than half of the time you fly
_____ Between 10% and 50% of the time you fly
_____ Once out of 10 flights to once in 30 flights
_____ Less than once in 30 times
_____ Never

d) Only to the extent of feeling sleepy, slightly weak, restless, and "queasy"
_____ More than half of the time you fly
_____ Between 10% and 50% of the time you fly
_____ Once out of 10 flights to once in 30 flights
_____ Less than once in 30 times
_____ Never

e) Very short-lived feelings of nausea which come on during certain violent maneuvers and pass off promptly
_____ More than half of the time you fly
_____ Between 10% and 50% of the time you fly
_____ Once out of 10 flights to once in 30 flights
_____ Less than once in 30 times
_____ Never

24. Were you liable to airsickness to any degree during the following stages of your experience? (You may consider yourself "liable," if, with rough air, or as a result of maneuvers, you stood a one out of twenty chance of feeling the effects of motion to the extent of grade d in #23 above.)

_____a) Your first two or three flights
_____b) Before your first solo or during your first 20 hours
_____c) From your 20th to 100th hour
_____d) From your 100th to 500th hour
_____e) From your 500th hr. and above

25. Do you now become airsick to any degree under the following circumstances?

Yes_____ No_____a) Rough air
Yes_____ No_____b) Ordinary maneuvers (vertical turns, "8s," spins, etc.)
Yes_____ No_____c) Acrobatic maneuvers
Yes_____ No_____d) Instrument flying
Yes_____ No_____e) When you read or use your eyes for close work
Yes_____ No_____f) When very tired
Yes_____ No_____g) When very cold
Yes_____ No_____h) When you see others sick
Yes_____ No_____i) When you do not feel well

26. Are there any other circumstances under which you become airsick to any degree? Yes_____ No_____
If "yes," what are the circumstances?

27. Is there anything in your medical history that might make you susceptible to airsickness?

28. Do you have any comments to make about your history of nausea from motion, about this questionnaire, or about the causes of airsickness?

Compiled by G. R. Wendt

APPENDIX A-4

MOTION-SICKNESS INVENTORY
December, 1941

Name_____ Date_____
Please print

Directions: Below are listed five moving vehicles and carriers whose motion can produce nausea (seasickness, car sickness, etc.). Think back over your own experience with each of these and answer according to this scale:

(x) Have not had enough experience to know whether I would be affected.
(1) Am now somewhat subject to sickness. Would probably vomit if the ride were long and rough.
(2) Used to be subject to sickness (a few years ago or as a child) but am not now subject to it.
(3) Have been somewhat subject to nausea, but not to the point of vomiting.
(4) Have never been affected by rides.

Check in the appropriate columns

	x	1	2	3	4
a. Rides in boats (seasickness)					
b. Rides as a passenger in autos (car sickness)					
c. Rides in trains					
d. Rides in street cars or subway trains					
e. Rides in buses					

Directions for items f to n. Below are listed other moving carriers. Indicate in each case whether the device has made you feel nauseated during the last four years. Use the following scale:

(x) Have not had enough recent experience to know whether I would be affected.
(1) I have been strongly nauseated (to the extent of vomiting or almost to it).
(2) I have been slightly nauseated (felt queasy).
(3) I have been unaffected.

	x	1	2	3
f. Elevator				
g. Hammock				
h. Lawn swing				
i. Merry-go-round				
j. Ferris wheel				
k. Roller coaster				
l. The Whip				
m. Airplane glider, loop-o-plane, etc.				
n. Airplane rides as a passenger				

If you have ever been sick as a result of the motion of any of the above or any other moving carriers, please list them:

Compiled by G. P. Wendt

STUDIES IN MOTION SICKNESS

Series B

II

AIRSICKNESS AMONG ONE HUNDRED EIGHTY-NINE AIRLINE STEWARDESSES AND ITS RELATIONSHIP TO PREVIOUS HISTORY OF MOTION SICKNESS

by

A. D. Tuttle
Medical Director
United Air Lines

and

G. R. Wendt
Head, Department of Psychology
University of Rochester

SUMMARY

A questionnaire was administered to 189 United Air Lines stewardesses requiring them to report the frequency and degree to which they had been airsick, and the conditions under which it occurred. The questionnaire also included an inventory of motion sickness on boats, trains, autos, and other devices. The frequency of airsickness was: 42% had vomited from airsickness; 36% had experienced lesser degrees of sickness; 22% had been completely free of sickness. An *a priori* scoring key was applied to the inventory of motion sickness on devices. Two people rated the airsickness part of the questionnaire for amount of sickness. The correlation of inventory and airsickness scores was .53, showing that history of sickness on other devices yields some useful prediction of airsickness. Significant conditions of airsickness, according to the stewardesses, were: rough air, fatigue, illness at time of emplaning, psychological factors, gastric factors, high altitude, odors, and heat.

AIRSICKNESS AMONG ONE HUNDRED EIGHTY-NINE AIRLINE STEWARDESSES AND ITS RELATIONSHIP TO PREVIOUS HISTORY OF MOTION SICKNESS

INTRODUCTION

This study was undertaken with the cooperation of Dr. A. D. Tuttle, Medical Director of United Air Lines. A questionnaire devised by Dr. G. R. Wendt was filled out by a group of airline stewardesses and forwarded to Wesleyan University for analysis. A study of the data suggested that a history of sickness on various devices appeared to yield some useful predictions of airsickness. Comparisons of comments of the stewardesses as to possible causes of sickness are reported.

PROCEDURES

1. Method of collecting data. The questionnaires were prepared at Wesleyan University and distributed by the office of the Medical Director of United Air Lines. Each stewardess received the questionnaire at her base, accompanied by a letter from Dr. A. D. Tuttle, Medical Director, requesting cooperation and promising that the data would be confidential. The stewardesses completed the questionnaires on their own initiative and returned them to the writer via the regional supervisor and the Medical Director's office. This survey was made in February and March of 1941.

2. The Questionnaire. The Experimental Questionnaire Form of January 14, 1941, was used (see Appendix A-3 of the first report in Series B). It provides space for name, age, and hours of flying experience. A section on previous history of motion sickness includes questions on sickness in boats, trains, street cars, automobiles, elevators, hammocks, lawn swings, merry-go-rounds, ferris wheels, roller coasters, the Whip, airplane glider, and loop o-plane. A section on airsickness requires report on the total frequency of each of five degrees of airsickness, on the present frequency of each degree of airsickness, on the stage of flying experience in which sickness occurred, and on conditions of sickness.

3. Scoring methods. The airsickness section was scored separately from that on history of motion sickness in other devices. Both scoring methods made use of certain a priori assumptions.

The scoring method for the section on seasickness, train sickness, etc., was objective. It assumed that history of sickness was greater as the frequency, severity, and recency of sickness increased. The method yielded high scores for lack of sickness (80 representing the top score) and low scores for sickness. (The lowest score was 2.4, obtained by a stewardess who had vomited from motion in automobiles and trains and who

had been nauseated to some degree by 3 out of 10 of the other devices.) The scoring method is described in Appendix A-1.

Two people categorized the airsickness records, each on the basis of somewhat different assumptions. No attempt was made to reduce this procedure to a set of rules, since we felt uncertain of their validity. An assistant, CRB, was asked to sort the questionnaires into piles of comparable degrees of sickness. This resulted in eleven categories. The assumptions she used were that airsickness was greater as its frequency, severity, and recency became greater. The questionnaires were later sorted by the writer on the assumptions that airsickness was greater as frequency and severity were greater, but without regard to recency. This resulted in twelve categories. In each case Category 1 contained those not sick to any degree.

The sortings by CRB and GRW correlated .92. Inspection of the cases on which there was disagreement showed that there were sources of disagreement in addition to the difference over the use of the recency assumption. GRW's Category 2 consisted of seven girls whose write-in comments indicated slight sickness, but whose check list indicated no sickness; CRB put all of these in Category 1 with the non-sick girls. Six girls whose sole airsickness was one occasion on which they vomited, and who wrote comments attributing this to causes other than motion, were put in Category 2 by CRB, Category 6 by GRW. Other cases of wide disagreement were due to differing decisions as to the weight to be given to qualifying comments.

4. Stewardess subjects. The stewardesses were all Registered Nurses. Their median age was 24 years; their age range 21-36 years. The average of flying hours was 1684 hours; the range 100-9000 hours. Of the 205 stewardesses in service at the time the questionnaires were sent out, 189 completed the form.

5. Possible limitations of methods. The following possible limitations may be noted: (1) No direct check on the extent to which concealment or exaggeration affected questionnaire replies was obtained. Perhaps the best evidence that there was not extensive concealment is the fact that 78% of the stewardesses reported some airsickness.[1] (2) Reliability of such a questionnaire is affected by fluctuations in reporting, by variations in interpretation of questions by the subjects, and by defects of the scoring procedure. No data were obtained to indicate relia-

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[1] In an unpublished study done for the Committee on Medical Research, the writer and collaborators found that only six-tenths of one per cent of items reported on a similar questionnaire administered to 349 naval officer trainees were significantly altered in interview 1 to 10 weeks later. Only a portion of the 0.6% could be attributed to incorrect report on the questionnaire or interview.

bility of this questionnaire when completed by the stewardesses.[2] (3) This paper presents the correlation of airsickness "scores" and scores based on previous history of motion sickness. Both scores are derived from the questionnaire. There is probably a small spurious elevation of the correlations produced by the fact that both depend on questionnaire responses. There are thus seen to be factors tending to lower the correlation (unreliability of scores) and to raise it.

RESULTS

1. Correlation of airsickness with motion sickness on other devices. We computed the Pearson product-moment coefficients of correlation between the scores based on history of motion sickness on devices other than airplanes, and the categories of airsickness as judged by CRB, GRW, and CRB plus GRW. The Pearson r's were as follows:

Airsickness (CRB) vs. history of other motion sickness, r = .43

Airsickness (GRW) vs. history of other motion sickness, r = .50

Airsickness (CRB + GRW) vs. history of other motion sickness, r = .53

GRW's airsickness ratings of 9 girls who vomited once in the air, but who at no other time developed any degree of sickness, set aside Category 6 for them. If it be assumed that these cases were only slightly susceptible to sickness, and if they are put in Category 2, thus reducing the total number of airsickness categories from 12 to 11, the r of these ratings with previous history of motion sickness is .53, instead of .50 as obtained from the original ratings.

It is of interest to examine the extreme cases in both the airsickness distribution and the history of motion sickness distribution. GRW's airsickness ratings are used for this purpose. Of the 36 girls with scores indicating the least history of sickness on other devices, 21 did not get sick in the air, 4 vomited more than once, and 11 had intermediate degrees of sickness. Of the 41 girls who did not get airsick, 31 had never been sick to any degree on any other device, 5 reported nausea only on one or more of the devices listed in Question 21, while 5 had been sick on boats, trains, autos, or street cars. The 20% of cases with greatest history of sickness on other devices contained no cases without airsickness, 29 cases

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[2] An unpublished study done for the Committee on Medical Research by the writer and collaborators gave a correlation of .92 between original and repeat scores on motion-sickness inventories administered 2 to 6 weeks apart to 147 naval officer trainees. The questionnaire used was the form of December, 1941. It is the writer's opinion that the form used on stewardesses might show a somewhat lower reliability because it is more difficult to fill out.

who vomited 2 to 100 times, and 9 cases with slight sickness. The 20% of cases with the worst airsickness records contained 33 cases who had been sick on other devices, and 5 cases who had not been sick. Of the latter cases, 4 lacked experience on several devices while only 1 had experience on all devices.

The correlation chart showing the scatter of cases on the variables, GRW's airsickness ratings, and scores from history of motion sickness, is included in Appendix A-2.

2. Frequency of airsickness and its relation to experience. The over-all results were that 42% of the stewardesses had been airsick to the point of vomiting, 36% to less than vomiting, and 22% not sick at all. Table 1 shows the results in detail. A point about our method of determining frequency of sickness needs mention. The stewardesses were asked to indicate the number of times they had been airsick (Question 22). Most of them complied with this. In some cases they did not, substituting a verbal description in place of a number. Several of these were girls with very frequent sickness. Three extreme examples follow:

> X, a 4500 hr. stewardess, wrote that sickness to the point of vomiting "Too numerous to mention" occurred. She indicated that this occurred from "once out of 10 flights to once in 30 flights" at the time of reporting.
>
> Y, a 2000 hr. stewardess, wrote that she was sick to the point of vomiting "Almost every trip for the first year I flew; even when it was smooth, I became quite ill to the point of vomiting." She indicated that she still got sick once in 10-30 trips.
>
> Z, a 1600 hr. stewardess, wrote, "For the first six months I flew, I was airsick to some extent every trip I made, and I average at least two trips a week which includes leaving and returning. At times I would become extremely airsick. I have experienced airsickness so many times I could never give definite figures..... I get airsick only when having a rough trip and up to date can even tolerate some of that, etc."

In such cases an estimated number of instances of sickness were assigned, i.e., X and Y were assigned 100 each and Z was assigned 40 (see Table 1). Including these assignments, there were 79 girls who vomited from 1 to 100 times. The number of cases who reported or were assigned each frequency is shown in Table 1.

Sixty-nine of the 189 stewardesses indicated that they had never been sick to the point of vomiting, but had been sick to a lesser degree on one or more occasions. The figures are reported in Table 2.

TABLE 1

FREQUENCY OF VOMITING AMONG STEWARDESSES

Total No. of Times Vomiting	Number of Stewardesses Reporting this Frequency of Vomiting
1	22
2	10
3	3
4	5
5	5
6	3
7	1
8	2
10	2
11	1
12	2
13	1
15	2
18	1
20	6
23	1
24	1
25	1
27	1
28	1
30	2
36	1
40	2
48	1
100	2
Total	79

TABLE 2

FREQUENCY OF SLIGHT AIRSICKNESS AMONG STEWARDESSES

Total No. of Times Sick	Number of Stewardesses Reporting this Frequency of Sickness
1	20
2	18
3	10
4	6
5	3
6	4
8	2
10	2
13	1
24	1
30	1
56	1
Total	69

The relationship of length of service to airsickness is of some interest. Among the 173 stewardesses who reported flying hours, the average length of service was 1684 hours. Those who had been airsick to the point of vomiting averaged 1370 hours, the slightly sick plus the non-sick, 1907 hours. Table 3 shows average hours of service (and age) in relationship to airsickness category. GRW's ratings were used. It will be recalled that Category 1 represents those not airsick, Category 12 the worst cases of airsickness. Categories 6 through 12 are vomiters except for one case in Category 7. Inspection of the table shows that there is no important relationship of length of service to airsickness. Tabulation from the questionnaires shows 11 out of 72 "vomiters" (15%) with service above 2500 hours, and 26 out of 101 non-vomiters (26%) with service above 2500 hours. This difference showing more "veterans" among the non-sick raises the possibility that some stewardesses gave up their positions because of chronic airsickness. In answer to a request from us, Dr. Tuttle reported that out of approximately 400 cases of separations from United Air Lines stewardess service, there were only three cases known to be due to chronic airsickness.

TABLE 3

AGE AND LENGTH OF FLIGHT SERVICE IN RELATION TO AIRSICKNESS

Degree of Airsickness	Average Age in Years	Average Hours of Service	Total N	N not Reporting Hours
1 (not sick)	26.0	2381	41	1
2	25.4	779	7	1
3	24.8	1625	35	4
4	25.5	1624	20	2
5	25.0	2185	6	0
6	24.3	733	9	0
7	24.6	923	12	2
8	25.6	1867	12	0
9	26.2	2638	9	2
10	24.7	921	13	1
11	25.4	1488	10	0
12	25.2	1340	15	3

The relationship of airsickness to amount of experience cannot adequately be judged from reports on this questionnaire. Question 24 is not a reliable index, because it was not completely answered by all stewardesses. Some checked only one answer even though the remainder of their questionnaire made it obvious that they should have checked all. For what they are worth, these are the data: "liable to airsickness" during the first two or three flights, 60 stewardesses; during the first 20 hours, 13; from the 20th to 100th hour, 44; from the 100th to 500th hour, 25; and above the 500th hour, 22. It may be concluded that airsickness is most frequent during early flights, and that some stewardesses con-

tinue to be susceptible even after long service. Among the stewardesses in the two worst airsickness categories (according to GRW's sorting which took no account of recency) 23 out of 25 were still susceptible to the point of vomiting at the time of reporting according to their answers to Question 23.

The ages reported by 185 out of 189 stewardesses are shown in the second column of Table 3 in relation to degree of airsickness. Inspection of the table indicates that age has no important relationship to airsickness in this group of subjects. One could not expect to find a clear relationship in the narrow range of ages represented: 76% of the stewardesses were aged 23, 24, 25, or 26.

3. Causes of airsickness according to stewardesses. The questionnaire provided two means by which the stewardesses could indicate their beliefs about the causes of airsickness, viz., a check list of causes in Question 25, and an opportunity for comments in Questions 26, 27, and 28. The first three are questions pertaining only to causes for their own airsickness, whereas Question 28 gave them an opportunity to discuss causes of airsickness in general.

The stewardess replies to Question 25 are shown in Table 4. This asked, "Do you now become airsick to any degree under the following circumstances?" and listed nine possible causes in which we had a special interest at the time. Four of these (b, c, d, and e) do not normally occur in airline flying of stewardesses, and were included in the questionnaire for the purposes of other studies. The three conditions most frequently checked as causes of their own airsickness in the case of the experienced stewardesses were "do not feel well," "very tired," and "rough air." It is to be noted that only two reported "cold" as a condition of sickness, and only 21 reported that they were affected by seeing others sick. In the latter connection, it may perhaps be assumed that the nursing training and experience of stewardesses was an aid in overcoming the effects of suggestion due to seeing others sick.

TABLE 4

CAUSES OF AIRSICKNESS CHECKED BY STEWARDESSES

Condition	No. of Stewardesses
a. Rough air	65
b. Ordinary maneuvers	6
c. Acrobatic maneuvers	12
d. Instrument flying	6
e. Reading or close eye work	12
f. When very tired	67
g. When very cold	2
h. When you see others sick	21
i. When not feeling well	89

Analysis of the comments written in by stewardesses (omitting those referring to "rough air") yields the results shown in Table 5. There were 22 classes of causes among the 315 separate assigned causes. The 79 stewardesses who had themselves been sick to the point of vomiting averaged 2.4 causes per stewardess; the 69 who had been sick to a degree less than vomiting averaged 1.3; while the 41 who had not been sick averaged 0.9. These differences are probably related to the degree of interest they have in the problem, and to their extent of knowledge of it.

The causes in Table 5 may be grouped into nine larger classes, as follows: 1. Psychological factors (A, B, C, and W), 80 comments. It is not entirely clear how large a proportion of these were intended to refer to nervousness or fear due to flight, but from the phraseology of the comments, one would judge that about half referred to other psychological causes such as grief, expectation of sickness, etc. 2. Gastric

TABLE 5

CAUSES OF AIRSICKNESS FROM STEWARDESS COMMENTS

		Number of Stewardesses Making Comment			
	Assigned Cause	Among 79 Vomiters	Among 69 Slightly Sick	Among 41 Not Sick	Total
A.	Fear or nervousness	16	8	7	31
B.	Expectation of sickness, suggestion	5	1	2	8
C.	Worry, grief, shock, excitement, etc.	9	8	6	23
D.	Fatigue	15	7	4	26
E.	Lack of sleep	8	2	3	13
F.	Hangover	3	0	2	5
G.	Overheated cabin	19	8	2	29
H.	Poorly ventilated cabin	10	4	0	14
I.	Odor of food	12	0	0	12
J.	Other odors	8	1	0	9
K.	Lack of oxygen at altitude	17	19	1	37
L.	Empty stomach	8	3	1	12
M.	Improper food	14	3	2	19
N.	Eating to excess	2	3	2	7
O.	Alcoholic intoxication	3	1	3	7
P.	Ill (colds, gastric upset, etc.)	12	13	2	27
Q.	Constipation	1	0	0	1
R.	Menstruation	3	1	0	4
S.	Taxiing	1	0	0	1
T.	Visual stimulation	5	4	1	10
U.	Head down	1	0	0	1
V.	Inexperience	15	3	0	18
	Total	187	89	39	315

(L, M, N, O), 51 comments; 3. Fatigue (D, E, F), 44 comments; 4. Low oxygen (K), 37 comments; 5. Odors and poor ventilation (H, I, J), 35 comments; 6. Illness before emplaning (P, Q, R), 33 comments; 7. Heat (G), 29 comments; and 8. Sensory (S, T, U), 12 comments.

Factors affecting the frequency of comments are probably the following: (1) The form of the questionnaire. Since Question 25 had already listed a number of causes, it may be assumed that these would tend not to be repeated in comments; (2) experience with their own and with passengers' airsickness; (3) specific teaching and indoctrination concerning causes of airsickness by the stewardess school and Medical Director's office. In this connection, the comment of Miss Florence M. Pond, stewardess instructress, is relevant:

> "One or a combination of two or more of the following are definite causes: - fear or nervousness, emotionalism, fatigue, inability to relax, hot, poorly ventilated cabin, improper excessive eating and drinking, motion due to rough air. I believe it is very important that a first rider be comfortable and at ease on first trip, with mind off self." Of her own airsickness (sick to the point of vomiting on "first 20 trips") she comments, "nothing medical, perhaps mental. I believe it takes a long time to get over the fear of being airsick, at least that was true in my case."

DISCUSSION

Comparison of the comments of the stewardesses who had been airsick with the comments of the non-airsick stewardesses shows two particularly striking differences: (1) Of those without experience of sickness, none mentioned odors or poor ventilation as causes of sickness, whereas 35 sick stewardesses mentioned these. (2) Of the non-sick, only 1 mentioned lack of oxygen as a cause of sickness, whereas 36 sick stewardesses mentioned this cause. The causes mentioned by the non-airsick fell mainly in the classes, psychological, fatigue, and gastric.

In considering the data as a whole one must take account of the fact that the stewardess, when not attending passengers, spends a great deal of her time in the tail of the plane far from its center of rotation, and is thus more exposed to the lateral movements from yawing. As regards oxygen want, although an oxygen outlet is available, the use of this while attending passengers is at best intermittent.

Airsickness Among One Hundred Eighty-nine
Airline Stewardesses and Its Relationship
to Previous History of Motion Sickness

II

APPENDIX A

Appendix A-1: Scoring Method for Questionnaire of January 14, 1941

Appendix A-2: Chart Showing Scatter of Motion-Sickness Scores and Airsickness Ratings for One Hundred Eighty-nine Airline Stewardesses

APPENDIX A-1

SCORING METHOD FOR QUESTIONNAIRE OF JANUARY 14, 1941

Questions 1, 6, 11, 16.

Alternative a = 0
b = 4, unless the subject lacked experience
c = 2, unless the subject lacked experience

If the subject lacked experience, as indicated by a check in items 3d, 8d, 13d, or 18d, items b or c were scored as described below under "assigned scores."

Questions 2, 7, 12, 17.

First alternative = 0
Second " = 1
Third " = 2
Fourth " = 4

Questions 3, 8, 13, 18.

The items following these questions did not receive a numerical score. The answers were used when assigned scores were required because of lack of experience. See above and below.

Questions 4, 9, 14, 19.

a = 0
b = 1
c = 2
d = 4

In case of no answer to this question an assigned score was given equal to the score on the question (2, 7, 12, or 17) coming two places before it in the same group.

Questions 5, 10, 15, 20.

a = 0
b = 1
c = 2
d = 3
e = 4
f = this item was assigned the same score as the question (2, 7, 12, or 17) coming two places before it in the same group or the same score as the question (1, 6, 11, or 16) coming three places before it in the same group, whichever was lower.

Assigned scores.

If a subject lacked experience on a device, a score was assigned to one, two or three of the questions in each group, depending upon the context of answers.

Items 1b or c, 6b or c, 11b or c, and 16b or c received an assigned score if the answer to the question coming two places after it was "d," i.e., no experience. In that case the "assigned score" was the average of the scores in the other three questions in the same group; for instance, in the seasickness group the value assigned to Question 1 would be the average of scores on Questions 2, 4, and 5.

Questions 4, 9, 14, and 19 were assigned scores if the subject left the question unanswered. See above for method.

Items 5f, 10f, 15f, and 20f were assigned scores as indicated above.

Question 21.

Each answer of "No" was scored 2.

Each answer of "Yes" or of "No experience" was scored 0.

Total score.

The total score was the sum of scores and assigned scores on all questions.

APPENDIX A-2

CHART SHOWING SCATTER OF MOTION-SICKNESS SCORES AND AIRSICKNESS RATINGS FOR ONE HUNDRED EIGHTY-NINE AIRLINE STEWARDESSES

Motion Sickness Scores

Airsickness Category	80-79	78-77	76-75	74-73	72-71	70-69	68-67	66-65	64-63	62-61	60-59	58-57	56-55	54-53	52-51	50-49	48-47	46-45	44-43	42-41	40-39	38-37	36-35	34-33	32-31	30-29	28-27	26-25	24-23
1	21	6	2	3	5	1		1		2																			
2		1	2			1	1	2																					
3	5	4	7	3	2	1	3			1	3	1	2	2		1													
4	3	4	1		1	1	2	1	2		2			1				1											1
5		1	1	1		1		1	1																				
6	3		1	1		3			1																				
7	1	1	3		2	1	1	2		1																			
8	1	2			1	1		1	1		1	1	1	1															
9	1	1		2		1	1			1					1								1						
10	1	1	1		1	1	3	1		1	1							1			1								
11						1	3	2			1	1					1			1								1	
12			1	1			1					1	2	2		2		1				3		1					

STUDIES IN MOTION SICKNESS

SERIES B

III

AIRSICKNESS AMONG SEVENTY-ONE STUDENT PILOTS AND FIFTEEN INSTRUCTORS AND ITS RELATIONSHIP TO PREVIOUS HISTORY OF MOTION SICKNESS

by

G. R. Wendt
Head, Department of Psychology
University of Rochester

SUMMARY

A questionnaire was administered to seventy-one civilian student pilots in the Civilian Pilot Training program of the CAA and to fifteen instructors in the same program. This required them to report the frequency and degree to which they had been airsick, and the conditions under which it occurred. The questionnaire included an inventory of motion sickness on boats, trains, autos, and other devices. The percentage frequency of airsickness was: vomiting, students 16%; instructors 20%; lesser sickness, students 52%; instructors 67%; not sick, students 32%; instructors 13%. An *a priori* scoring key was applied to the inventory of motion sickness on devices other than planes, and the writer sorted the questionnaires into categories of comparable airsickness records. The correlation of motion sickness-inventory score and airsickness category was .73 in the case of student pilots and .34 in the case of instructors. The pilots attributed their airsickness in large part to training maneuvers, especially when long continued, and to a lesser extent to other causes.

AIRSICKNESS AMONG SEVENTY-ONE STUDENT PILOTS AND FIFTEEN INSTRUCTORS AND ITS RELATIONSHIP TO PREVIOUS HISTORY OF MOTION SICKNESS

INTRODUCTION

The following study represents another investigation in the area of motion sickness conducted by Dr. G. R. Wendt at Wesleyan University under the auspices of the Committee on Selection and Training of Aircraft Pilots. A questionnaire devised by Dr. G. R. Wendt was administered to 71 Civilian Pilot Training students at Wesleyan University and at Purdue University, with the purpose of attempting to assess the relationship of frequency of airsickness to previous history of motion sickness. The same general procedures utilized in a study of airsickness among civil airline stewardesses reported in the second study in Series B was employed in this investigation.

PROCEDURES

The Experimental Questionnaire Form of January 14, 1941, (see Appendix A-3 of the first study in Series B) was administered to flyers at Wesleyan University, and by Dr. E. Lowell Kelly to flyers at Purdue University. The scoring and sorting were done as in the stewardess study, the writer being responsible for the airsickness ratings (see p. 60). The latter ratings were made on the basis of frequency and degree of airsickness, with no regard to recency of sickness. Each group (students and instructors) was sorted into seven categories of amount of airsickness.

The subjects were all in the Civilian Pilot Training program of the Civil Aeronautics Administration. The student median age was 21 years (range 19 to 26), their average flying hours, 40 (range 1-1/2 to 145 hours). Sixty-nine of the students completed the questionnaire when they reached the end of the CPT primary course, twelve had had less experience. Those cases with large amounts of flying time had accumulated passenger flight hours before training. The instructor median age was 25 years (range 21 to 42), their average flying hours 762 (range 70 to 2500 hours). So far as we can determine no special selective factors operated in the sampling of subjects. We obtained questionnaires from all CPT students then at Wesleyan (N = 31) and at Purdue (N = 40).

RESULTS

1. <u>Correlation of airsickness with motion sickness on other devices</u>. The Pearson product-moment coefficients of correlation between the scores based on history of motion sickness on devices other than airplanes and the categories of airsickness as judged by the writer

were computed for each group. The r's were:

CPT student pilots r = .73

CPT instructors r = .34

These may be compared with the r of .53 obtained in the study of airsickness among civil airline stewardesses.

The student group contained one very unusual case. In an estimated 100 hours of non-student experience, and 26 hours of student experience he estimated that he had been sick to the point of vomiting 50 times. He had also been sick to the point of vomiting on boats, trains, street cars, and automobiles, and nauseated on all of the other devices listed. The boy's father was a private plane owner, and the boy himself was highly motivated to fly. This case alone has considerable effect on the correlation. If he were assigned an airsickness score based on the actual amount of sickness (rather than merely being put in the highest of seven categories), the r with the motion-sickness history score would be considerably raised. If he is removed from the group, the r drops from .73 to .65.

2. Frequency of airsickness and its relationship to other variables. Among the student flyers, 11 had been sick to the point of vomiting from 1 to 50 times; 37 had been sick to a degree less than vomiting; 23 had not been sick to any degree. The average age in every one of the seven airsickness categories was either 20 or 21, and there was no relationship to degree of sickness. Flying hours were also unrelated to airsickness, presumably because of the fact that most of the students had comparable experience. The 42 least sick men (23 not sick, 19 very slightly sick) averaged 38 hours, the 29 most sick averaged 41 hours.

Among the instructors 3 had been sick to the point of vomiting 1, 3, and 5 times; 10 had been sick to a degree less than vomiting, while 2 had not been sick to any degree. The seven sickest instructors averaged 27 years old and 726 hours of experience; the eight least sick averaged 28 years old and 793 hours of experience.

The questionnaire gave an opportunity to indicate the stage of flying experience at which airsickness occurred (Question 24). Table 1 shows the number of students and instructors who indicated some degree of susceptibility at various stages. It would appear from inspection of this table that the early period of flying is the period of most frequent sickness for students.

Table 2 shows the assigned causes of continued airsickness according to Question 25. It may be remarked that these flyers tend to blame their own physical status and training maneuvers for the occurrence of airsickness.

TABLE 1

SUSCEPTIBILITY IN RELATION TO STAGE OF FLYING

Stage When Susceptible	Number of Students	Number of Instructors
a. First 2 or 3 flights	13	4
b. Before solo or during first 20 hrs.	25	2
c. 20th to 100th hour	9	5
d. 100th to 500th hour	1	4
e. Above 500th hour	0	1

TABLE 2

CAUSES OF CONTINUED AIRSICKNESS FROM QUESTIONNAIRE CHECKS

Condition	Number of Students	Number of Instructors
a. Rough air	9	
b. Ordinary maneuvers	16	
c. Acrobatic maneuvers	19	2
d. Instrument flying		
e. Reading or close eye work	3	
f. When very tired	5	
g. When very cold	2	
h. When seeing others sick	10	1
i. When not feeling well	25	5

The comments written in response to Questions 26, 27, 28 were analyzed with respect to the causes given for the motion sickness experienced by the flyers themselves. To facilitate comparison with our previous study of stewardesses, we are including similar categories as presented in the report of that study. The results of the present study appear in Table 3. Conditions A through L were mentioned by both stewardesses and pilots; conditions M through S by pilots only. Causes assigned by more than one stewardess, but not mentioned by the pilots were: emotional shocks, odor of food, anoxemia, intoxication, and menstruation. In the present study, comments on the effects of rough air, and of inexperience were omitted from the tabulation because too many of them appeared as implications of other comments rather than being stated directly. It may be remarked that the pilots differed from the stewardesses in the very much smaller place assigned to psychological causes and (as would be expected) the greater mention of training maneuvers as a cause of sickness. Spins and excessive exposure to maneuvers were pointed out as especially troublesome.

TABLE 3

CAUSES OF OWN AIRSICKNESS FROM COMMENTS

Assigned Cause	Number of Students	Number of Instructors
A. Nervous temperament	2	
B. Expectation of sickness	2	
C. Fatigue	4	
D. Hangover	1	
E. Heat	3	1
F. Odors or ventilation	5	5
G. Empty stomach	1	1
H. Improper food	3	
I. Flying too soon after eating	5	
J. Ill from other causes	4	3
K. Constipation	1	
L. Visual	6	1
M. Smoking or coffee	2	
N. Too early in morning	1	
O. Acrobatics	6	2
P. Slips, stalls, pull-outs, steep turns	10	
Q. Spins	15	
R. Not at controls	8	
S. Long exposure to one condition	15	1

No student commented on causes of airsickness in others. Only two instructors added such comments. The assigned causes were: nervous 2, apprehensive 1, tense 1.

DISCUSSION

The number of cases included in this study is obviously too few to yield frequencies or correlations with a usefully low standard error. The results are presented as a matter of record, so that they may be combined with those of other studies to assist in reaching conclusions. The correlations obtained between airsickness and previous history of motion sickness appear to be in the expected direction and are not far from the magnitude obtained in our study of stewardesses.