

Situations that Cause Pregnant Women to Feel Unsafe near Other Pedestrians: a Quantitative Analysis

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Abstract

Pregnant women often feel uneasy when they go through spaces crowded with pedestrians. They tend to avoid going out to town out of the worry that they might bump against others and cause serious physical damage to themselves and the unborn baby. This study examines the functional relationships between pregnant women's feelings of danger and several potentially influential situational factors as a step toward developing designs for public spaces that are safe and comfortable for pregnant women.

1. Introduction

In Japan, the enactment of the so-called Transportation Barrier-free Law in 2000 reduced many of the physical barriers that previously made it difficult for those such as the disabled, elderly, or expecting to get around in the cities. Such improvements in physical accessibility go a long way toward encouraging these members of society to become more active, but do not necessarily address the psychological barriers that still keep many from going out. Chief among these obstacles is the fear of crowding in public spaces. In particular, pregnant women often feel unsafe when they go through spaces crowded with pedestrians because they fear that their pregnancy might not be obvious from their appearance. Thus they tend to avoid going out to town out of the worry that they might bump against others and cause serious physical damage to themselves and their unborn babies. This study examines the functional relationships between pregnant women's feelings of danger and several potentially influential situational factors as one step toward developing designs for public spaces that are safe and comfortable for pregnant women.

2. Method

Subjects included 102 pregnant women and 22 female students who served as a control group.

In session 1, subjects answered a questionnaire on how unsafe they usually feel in such situations as riding a crowded train car, going down steps, or walking over bumps. Next in session 2, subjects

viewed movies of a railway station taken at different times of day (i.e., different degrees of crowdedness) and rated how unsafe they would feel in each setting. Finally in session 3, subjects rated their feelings of danger upon viewing movies in which (a) a pregnant woman brushes past a couple coming from the other way, and (b) a pregnant woman encounters a pedestrian while going around the corner of a building. To verify the data obtained through the simulations, the female students were also asked to experience and rate the same situations in real-life settings. To guard against possible accidents, however, the pregnant subjects were excluded from this portion of the experiment.

3. Results

3.1. Session 1: Ratings of verbally described situations

The results of session 1 confirmed the common expectation that pregnant women feel more sensitive about their own safety in many public spaces than others do. In the case of riding a crowded train car, for example, 100 percent of the pregnant women said they feel unsafe at least to some degree, compared to the less than 40 percent of the female students who gave the same answer. Similarly, more than 90 percent of the pregnant women felt unsafe when going down steps and walking over bumps, while less than 20 percent of the women who were not pregnant felt the same way.

3.2. Session 2: Relationships between judgments of danger and crowdedness

For this part of the experiment, subjects rated how unsafe they would feel in each of the five situations indicated in figure 1. The data was then analyzed to determine the functional relationships between subjects' judgments of danger and three objective measures of crowdedness, namely density (D), average velocity of pedestrian movement (V), and pedestrian flow rate ($P = D \times V$). As shown in figure 2, subjects' judgments of danger were found to be well related to pedestrian flow rate, particularly in cases where the pregnant subjects imagined having to cut perpendicularly across the flow of pedestrians or having to enter a place where pedestrians move in many different directions at once. As for going up and down steps, pregnant subjects tended to feel unsafe even when the pedestrian flow rate was relatively low. They felt safer about walking parallel along with the pedestrian flow, however.

3.3. Session 3: Subjects' fearfulness of approaching pedestrians

(a) Brushing past a couple

In this session, subjects rated their feelings of danger upon viewing movies in which a pregnant woman brushes past a couple coming from the other way. As shown in figure 3, the variables in this experiment consisted of the distances between the pregnant woman and the couple at two points in the simulation, first when the couple corrects their path to avert collision (L) and later again when the two parties pass one another (W). Significant differences were found between the data obtained through the movie simulations versus in real-life settings, meaning that most of the data from the simulations could not be verified. However, the portion of the data that was successfully verified suggested that subjects' judgments of danger were significantly related to the timing at which the couple corrected their path to avert collision.

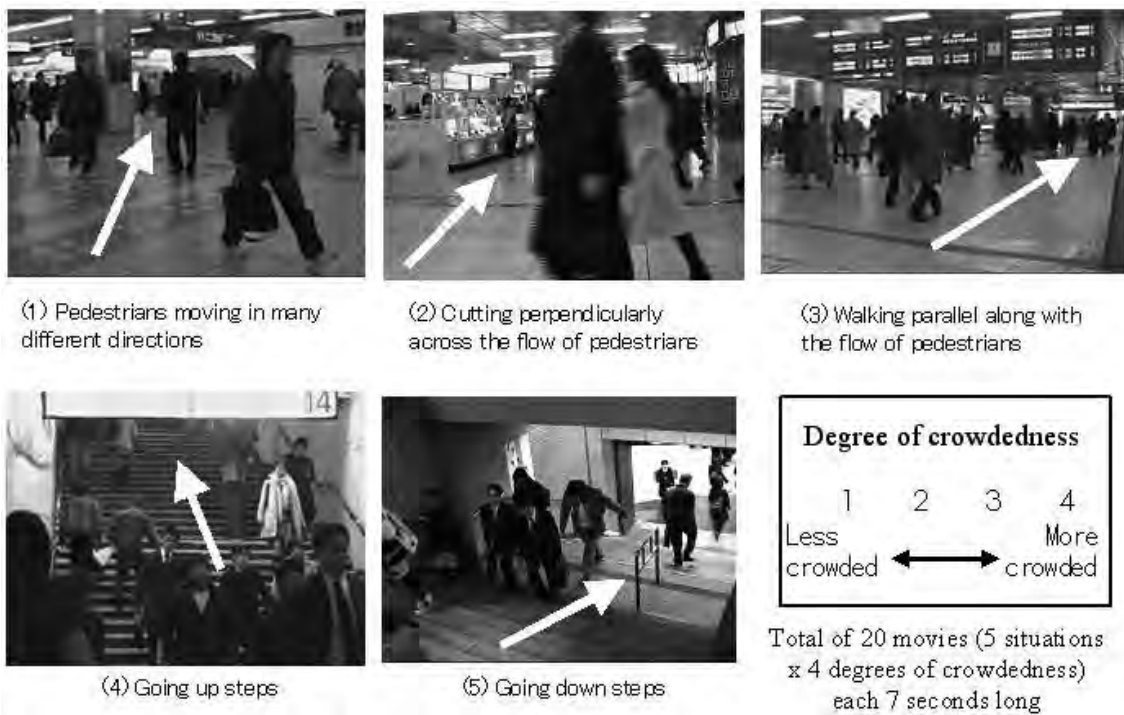


Figure 1. Session 2: Five different situations used as stimuli

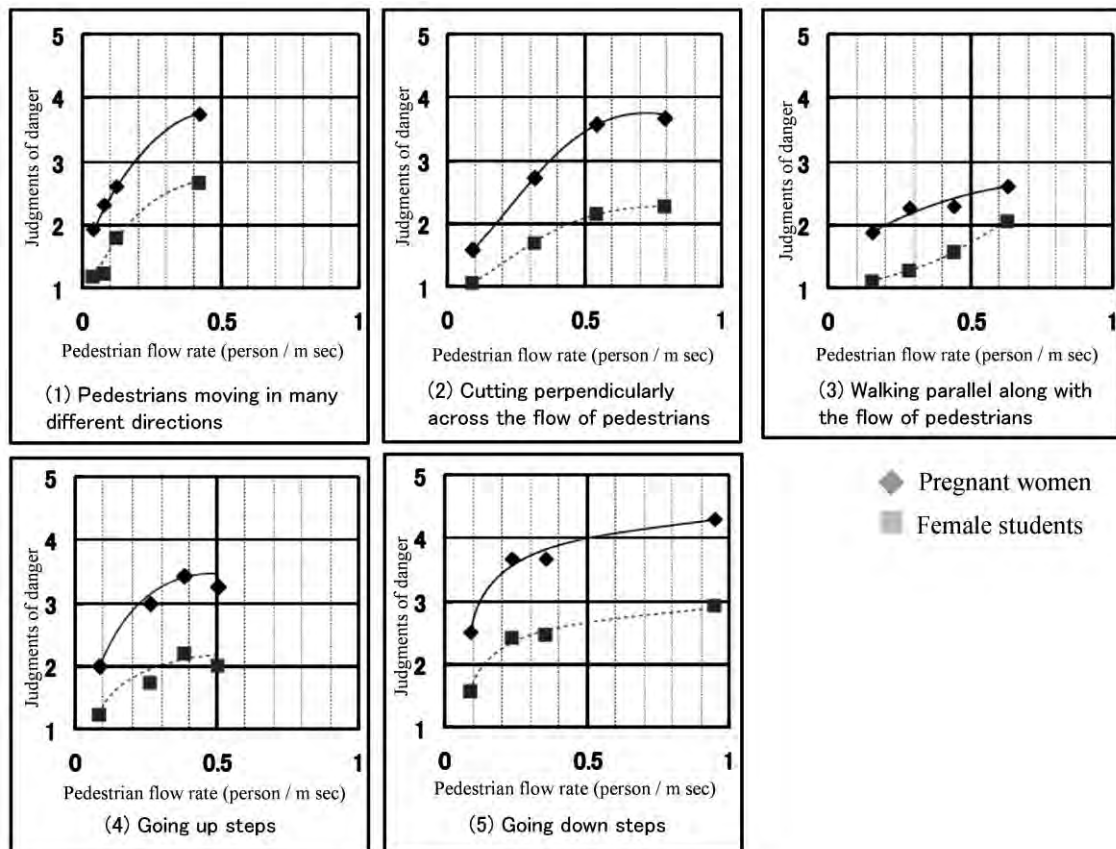


Figure 2. Session 2: Relationships between judgments of danger and pedestrian flow rate

Variables: Distances L and W between the pregnant woman and the couple

L (m)	0.6	1.2	2.4	4.8
W (m)	0.6	0.6 1.2	0.6 1.2 1.8	0.6 1.2 1.8

+3 seconds into simulation:
Couple corrects their path
to avert collision

+4.5 seconds:
The couple and pregnant
woman pass one another

+7 seconds:
End of simulation

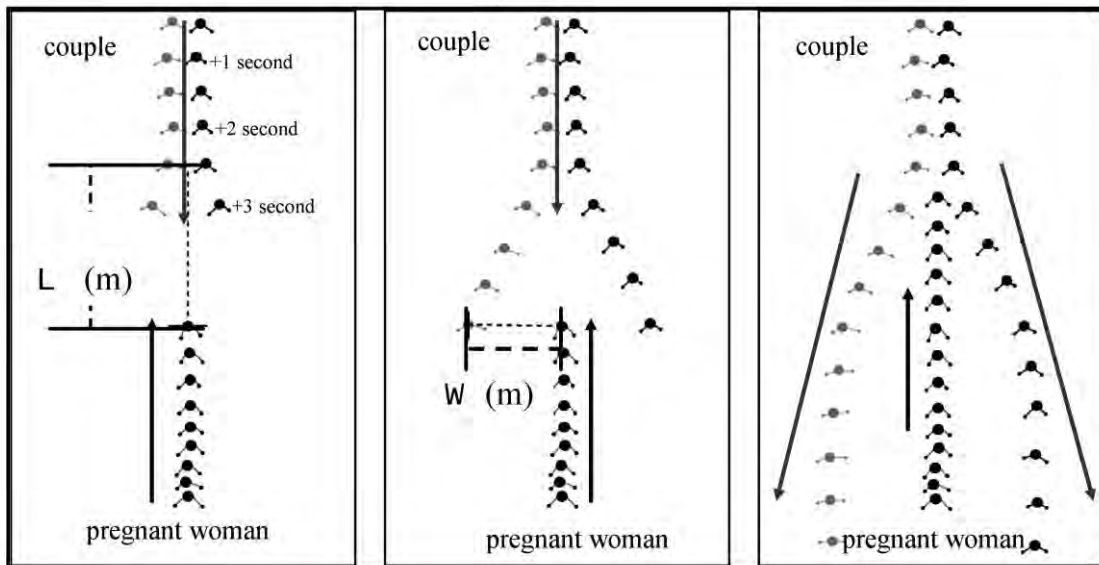


Figure 3. Session 3(a): Experimental setting and variables

(b) Encountering a pedestrian while going around the corner of a building

In this session, subjects rated their feelings of danger upon viewing movies in which a pregnant woman encounters a pedestrian while going around the corner of a building. The variable in this experiment was the distance X of the pregnant woman to the expected point of collision at the moment when the approaching pedestrian first enters her field of vision (see figure 4). Most of the data for this set of simulations was successfully verified by the real-life tryouts with the female students. From these results, it was found that the degree of danger felt by the subjects correlated to the amount of time left to avoid collision after the pregnant woman first notices the approaching pedestrian. Compared to the students, the pregnant subjects needed significantly more time before collision for them to be able to judge a situation as safe. Figure 5 analyzes the findings to determine how far in advance pregnant women might need to see an approaching pedestrian in order to feel sufficiently assured of their own safety.

Variable:
 The distance X from the pregnant woman
 to the projected point of collision
 $X = 0.5 \text{ m}, 1 \text{ m}, 1.5 \text{ m}, 2 \text{ m}$

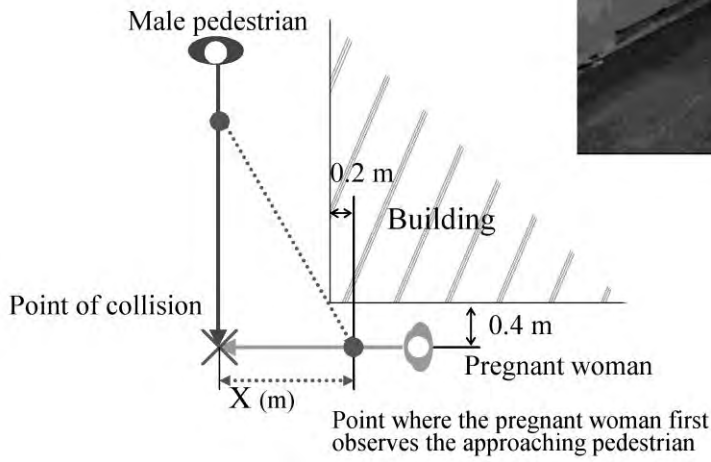
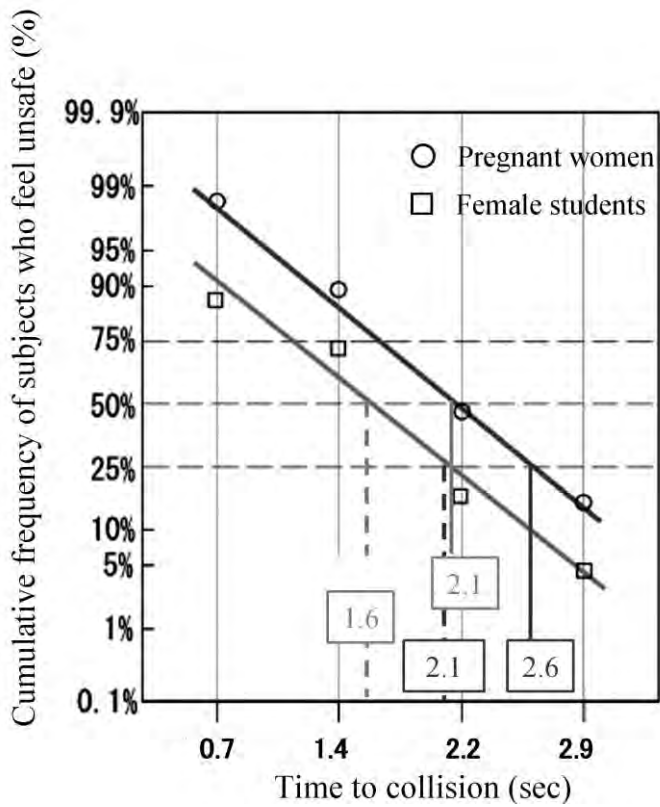


Figure 4. Session 3(b): Experimental setting and variable



Walking speed of
 the pregnant woman: 0.7 m/sec
 the male pedestrian: 1.4 m/sec

Figure 5. Relationship between time to collision and cumulative frequency of subjects who feel

4. Conclusion

The results of the study generally support the hypothesis that pregnant women are far more sensitive about their own safety than are non-pregnant women. The study also found judgments of danger to be well related to type and amount of pedestrian flow, suggesting that pregnant women will benefit from public spaces that are designed to effectively control patterns in pedestrian traffic. Finally, the study revealed that the degree of fear felt by pregnant women toward approaching pedestrians was correlated to the amount of time left to avoid collision. Data from this portion of the study will prove useful in developing designs for pedestrian pathways that have enough width and visibility and that are set far enough away from the sides of buildings.