It is acknowledged that ancestry may play a role in the likelihood of reporting motion sickness, based upon questionnaires in which symptoms are reported more frequently in individuals with Asian ancestry. This study compares motion sickness and related vertigo syndromes in Thai and Thai-Chinese populations.

The Motion Sickness Questionnaire; Albany Panic and Phobia Questionnaire; Acrophobia Questionnaire; Body Symptoms Questionnaire and the Situational Characteristics Questionnaire were administered to 128 participants. Eighty-eight participants had a father, mother and all grandparents of Thai origin, while 44 participants had at least one Chinese ancestor among parents or grandparents.

All responses were similar between groups except regarding fear of heights, which is significantly higher in Thai participants without recent Chinese ancestors.

Reported motion sickness sensitivity is similar between Thai and Chinese populations. The group differences for some fear of heights items may be linked to each group's previous experience with heights. Results also suggest that although conquering a fear of heights might require specific visuo-vestibular adaptations, these adaptations alone may not be sufficient to lessen an individual's fear of heights.

**Key words:** motion sickness, fear of heights, vertigo syndromes, Asian populations
INTRODUCTION

As far as in 300 AD the Chinese already differentiated terms to describe several forms of motion sickness (MS) (Brandt, Bauer, Benson & Huppert, 2016), and Asians also seem to be more prone to report MS symptoms. It is suggested that ancestry may play a role in motion sickness, as there is some evidence that it occurs more frequently in individuals with Asian heritage when compared with Europeans (e.g., Klosterhalfen et al., 2005; Stern et al., 1993, 1996; Stern & Koch, 1996; Xu et al., 1993). This hypersensitivity has been reported in experimental as well as in clinical situations. For example, it has been reported that people of Chinese heritage tend to emphasize somatic symptoms, as opposed to the tendency of „Western” populations to report symptoms in psychological terms (e.g., Dere et al., 2013, Ryder et al., 2008). But these findings should not be over-generalized, as westerners may inversely emphasize somatic symptoms of anxiety to a greater degree than Chinese (Zhou et al., 2011).

It is also noteworthy that the mechanisms underlying motion sickness, like nausea and co-morbid balance disorders, anxiety disorders and migraine, involve central pathways that can produce symptom expression that both somatise and psychologize perceptions (Balaban, Jacob & Furman, 2011; Balaban & Yates, 2017, Staab, Balaban & Furman, 2013). Simply stated, interoceptive processing may contribute to somatization, while cognitive domain processing can contribute to psychologization and both might affect motion sickness.

Motion sickness is one of the somatic conditions that is reported more often among women than men (see also: Barsky, Peekna & Borus, 2001; Wool & Barsky, 1994). For example, Park and Hu (1999) compared reported data from surveys with a behavioral visual motion provocation (optokinetic rotating-drum) and found that although women reported significantly greater incidence of feeling motion sickness than men, they showed no significant differences while viewing a rotating optokinetic drum. Kloslucher and colleagues (2015) further reported that women were more susceptible to motion sickness arising from linear motion, compared to rotational motion.

One intriguing possibility from cross-cultural investigations is the suggestion of a cultural shaping in anxiety and depression symptoms reported by Chinese patients (mainly of Han ancestry) versus patients of other ancestry (Dere et al., 2013). We suggest that the perception of balance-related symptoms provide a good test case for the generality of the observations from other settings that people of Chinese ancestry might tend to somatize distress. However, the contribution of genetic and cultural factors (e.g., linguistic relativity) in motion sickness and anxiety needs to be explored.

Consistent with reports of gender and ethnic tendencies to somatize distress, Stern and colleagues (1993) reported that Chinese women (n=15) compared to European-American (n=15) and African-American women (n=15) experienced significantly more symptoms of circular vection-induced motion sickness during exposure to a rotating optokinetic drum. Muth and colleagues (1994) also noticed
that American-born children of Asian parents (10 Chinese, 7 Taiwanese, 13 Korean) reported more symptoms, showed more gastric tachyarrhythmia, and requested early termination of drum rotation more often than the controls. In another study, Klosterhalfen and colleagues (2006) examined 48 healthy young adults (24 Chinese, 24 white) exposed to circular vection in a conventional rotation drum, with half of the participants performing nausea-enhancing head movements. Rotation tolerance was significantly shortened for Chinese compared with white participants. Genetic mechanisms may account for these results and are corroborated by twin studies (e.g., Reavley et al., 2006).

According to Jacob and colleagues (1993, 1996, 2009), a more subtle, psychologized situational distress than motion sickness is called space and motion discomfort (SMD). Similar to the visually induced vertiginous symptoms described by Bronstein (1995), these symptoms elicited by complex visual scenes in the periphery and are often accessed by the Situational Characteristics Questionnaire (Jacob et al. 1993). SMD is often found in some patients with vestibular disorders which also complain of an increase in dizziness and disorientation when exposed to complex visual scenes such as grocery stores, stripes on the walls or lighting filtering in through blinds (Whitney, Alghadir & Anwer, 2016). Multisensory and vestibular integration might have a leading role in dizziness symptomatology (Viaud-Delmon, Venault & Chapouthier, 2011) and the situations that elicit SMD are also associated with conditions that have an enhanced potential to create visual-vestibular conflicts (Coelho et al. 2017; Yardley, Luxon, Lear, Britton & Bird, 1994; Yardley, Britton, Lear, Bird, Luxon, 1995). Some anxiety-related disorders; mainly agoraphobia and panic are related to SMD and may have visual-vestibular aetiological factors, similar to motion sickness (Viaud-Delmon, Berthoz, & Jouvent, 2002; Riccio and Stoffregen, 1991) and as such were also assessed in this study.

Another related medical condition is height vertigo (Brandt et al. 1979) or visual height intolerance (vHI) (Huppert, Grill & Brandt, 2013). Fear of heights has a long medical history (Huppert, Benson, Krammling & Brandt, 2013), and is often included among dizziness and vertigo syndromes (e.g., Huppert, Benson & Brandt, 2017; Huppert & Brandt, 2018). There seems to be a continuum from acrophobia to visual height intolerance (Brandt, & Huppert, 2014), which does not fulfill the diagnostic criteria of specific phobia (Bauer, Huppert, & Brandt, 2012). Brandt, Bles, Arnold and Kapetyn first addressed the effect of heights on postural stability (see Brandt, Bles, Arnold & Kapetyn, 1979, Brandt, Arnold, Bles & Kapetyn, 1980, Bles Kapetyn, Brandt & Arnold, 1980). Brandt and colleagues knew that self-movement resulting in a visual flow of 20 minutes of arc was the threshold to detect movement (Liebowitz, 1955). However, as eye-object distance increases, head sway needs to increase as well, and at 20 m, the required postural sway is about 10 cm, defying the ability to maintain postural stability. At these distances, conflicting information to the vestibular and somatosensory systems is provided, and the vestibular and somatosensory systems must override the visual system to maintain balance (Coelho & Balaban, 2015; Salassa,
Zapala, 2009), and an increased reliance on vision seems to promote disequilibrium (Coelho & Wallis, 2010). Among persons with motion sickness, 45% reported vHI, comparatively to only 26% participants reported vHI, without motion sickness (Brandt, Grill, Strupp & Huppert, 2018).

Asian populations’ susceptibility to motion sickness and other dizziness and vertigo syndrome studies were done mainly among Chinese people, also using some participants of Taiwanese, Korean and Japanese ancestry (eg., Liu et al., 2002; Stern et al.,1996). Less is known relatively to Thai persons, including a distinct population with recent Chinese ancestry, which is the primary objective of the present study.

It is noteworthy that natives of mainland Southeast Asia are currently classified according to their linguistic affiliations into five major groups: Tai-Kadai, Sino-Tibetan, Austroasiatic, Hmong-Mien and Austronesian (LeBar et al., 1964; Lertrit et al. 2008). The Thai population has absorbed several waves of migration from southern China throughout its recent history contributing to substantial gene flow (e.g., Coedes, 1966; Wangkumhang et al. 2013). The population of Thailand also includes a number of ethnic minorities from South Asia. For example the mountain slopes of the North, around the city of Chiang Mai, are populated by about 500,000 people called Hill Tribes (Besaggio et al., 2007). Indian and Chinese genetic influences also exist and the Indian genetic influence seems more dominant in the southern Thai population compared with the northern population. However, some Chinese ancestry seems to exist in both northern and southern Thailand (Vongpaisarnsin, et al. 2015). Vongpaisarnsin and colleagues (2015) also note that Chinese military history records describe migrations into Thailand and its neighbors, over the past one thousand years. Based upon historical arguments, Eberhard (1977) has claimed that ancestors of the Thai people migrated from southern China into Southeast Asia during the second millennium AD; more recent studies have endorsed this assertion (e.g., Letrit et al., 2008). Over millennia, these migration patterns have resulted in predominant gene flows from southern China to northern Thailand (hill tribes) and from Chinese Han and Japan populations to southern Thailand, but these regional tendencies are far from segregated. The net effect of these historical migrations is that a significant proportion of Thai people have some Chinese heritage. Hence, recent Chinese heritage was used to define groups in this study.

**MATERIAL AND METHODS**

**Participants**

University undergraduate students from Chulalongkorn University were recruited as voluntary participants. The protocol was approved by the institutional ethical review board of the Chulalongkorn University for compliance with the Declaration of Helsinki Convention on Human Rights and Biomedicine, the Council for International Organizations of Medical Sciences and the Guide to Good
Clinical Practices. All participants provided written informed consent. Data from 167 participants were collected initially. Twenty-six participants with Western (Caucasian) ancestry and 13 participants with missing data relative to their ethnic or racial origins were excluded from the analysis. Data from the remaining 128 participants average age of 23.45 years old (SD=0.89)) were used for this study. Eighty-four of these participants (65 females and 19 males) had a father, mother and all grandfathers of Thai origin, while 44 (32 females and 12 males) have at least one Chinese ancestor among the previous two generations. Participant’s age difference between groups was not significantly different (HSD tests, P > 0.05).

Methods and Measurements

Participants filled out several published and validated questionnaires. All instruments were translated from English into the Thai language and re-translated into English by different and experienced bilingual experts to ensure validity. These measurement tools were tested in a Thai setting and the Cronbach’s alpha results were as follows: 1) Motion Sickness 0.861 (n=90); 2) Albany Panic and Phobia Questionnaire 0.768 (n=87); 3) Acrophobia 0.933 (n=88); 4) Body Symptoms Questionnaire 0.922 (n=90); 5) Disorientation Sensitivity Questionnaire 0.952 (n=79).

Motion Sickness was assessed with the Motion Sickness Susceptibility Questionnaire (Golding, 1998). The Motion Sickness Susceptibility Questionnaire: (Golding, 1998; Golding, 2006) Reliability of the whole scale gave a Cronbach’s standardized item alpha of 0.86, and test-retest reliability may be assumed to be better than 0.8. Predictive validity of the MSSQ for motion sickness tolerance using laboratory motion devices averaged r = 0.45.

Panic was assessed with the Albany Panic and Phobia Questionnaire (Rapee, Craske, & Barlow, 1994). The psychometric properties of the 27-item Albany Panic and Phobia Questionnaire (APPQ) have high levels of scale reliability and factor determinacy and concurrent validity (Brown, White & Barlow, 2005, Rapee, Craske & Barlow, 1994).

Acrophobia was assessed with the Acrophobia Questionnaire (Baker, Cohen & Saunders (1973; Cohen, 1977), which describes 20 situations frequently mentioned by people with acrophobia as anxiety provoking (e.g., standing next to an open window on an elevated floor). This instrument shows good internal consistency and test-retest reliabilities.

The Bodily Sensation Questionnaire (BSQ) (Chambless, Caputo, Bright, et al. (1984) contains 17 items which list body sensations that are usually reported as being associated with fear and that clients report being disturbing. Example items include heart palpitations, dizziness, and feelings of short breath. Participants report how frequently they experienced these symptoms on a 5-point Likert scale. The BSQ has very good internal consistency, stability, and concurrent validity (Fischer & Corcoran 1994).

The Disorientation Sensitivity Questionnaire or Situational Characteristics Questionnaire (SitQ) (Jacob R.G, Woody S.R, Clark D.B, Lilienfeld S.O, 1993)
was designed to measure SMD. The SitQ is recommended for quantifying SMD in patients with anxiety or balance disorders. The scores evaluate situations characterized by (a) long visual distances (e.g., fields, wide streets, courtyards); (b) confusing or complex visual stimuli (e.g., fluorescent lighting or moving stripes); (c) combinations of unusual or complex visual, proprioceptive and vestibular cues (e.g., widescreen movies, walking down supermarket aisles); (d) excessive vestibular stimulation (e.g., dancing); and (e) movements involving neck extension and reorientation with respect to gravity (e.g., closing eyes in shower, looking up at tall buildings) (Jacob, Redfern, Furman, 1995).

**Statistical analysis**

IBM SPSS Statistics for Windows (IBM Corp. Released 2013, Version 22.0 or 24. Armonk, NY: IBM Corp.) was used for all analyses. Binary logistic regression was used as an exploratory tool to identify questionnaire items that distinguished groups on the basis of ancestry (Thai versus Chinese) and gender (male versus female). Analysis of variance followed by Tukey HSD or Gomes-Howell comparisons tested the hypothesis that item responses varied among subject groups. The criterion for significant effects was $p < 0.05$.

**RESULTS**

Because the Fear of Heights Scale, Body Symptoms Questionnaire and Space, and Motion Discomfort Inventory data violated the assumption of homogeneity of variance, Gomes-Howell tests were used for paired comparison of subject groups. No significant gender or ethnicity differences were identified for the Body Symptoms scale or the Space and Motion Discomfort scale. By contrast, the Fear of Heights scale was markedly higher (Gomes-Howell test, $p<0.01$) for female subjects of Thai ancestry ($39.6 \pm 2.5$ SE) than for female subjects of Chinese ancestry ($24.7 \pm 3.6$ SE); the male subjects had intermediate responses which did not differ from the other groups (Thai ancestry: $33.7 \pm 4.6$ SE; Chinese ancestry: $32.8 \pm 5.8$ SE). At the level of single items, it was striking that Females of Chinese ancestry had significantly lower ratings than Females of Thai ancestry (Gomes-Howell tests, $p<0.01$) for responses to four items (Table 1); these differences among females contributed to significantly lower scores for all individuals of Chinese origin on these items (FH8, $p<0.05$; FH 15, $p<0.01$; FH 18, $p<0.05$; FH 20, $p<0.01$).

| Table 1. Fear of Heights (FH) and Motion Sickness Susceptibility Questionnaire (MSSQ) Items |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|
| Mean± Standard Error                          | Thai ancestry   | Chinese ancestry|
|                                              | Male            | Female          | Male            | Female          |
| FH8 Airplane trip                            | 2.26± 0.31      | 1.69 ± 0.30     | 1.75 ± 0.29     | 0.94 ± 0.29     |
| FH15 Standing on the edge of a subway platform | 1.16 ± 0.10     | 1.80± 0.016     | 0.50± 0.38      | 0.69± 0.23      |
| FH18 Riding an elevator to the 50th floor    | 1.68± 0.35      | 1.79± 0.19      | 2.50± 0.44      | 0.50± 0.27      |
| FH20 Walking up the gangplank of an ocean liner | 2.00 ± 0.03     | 2.72± 0.80      | 1.75± 0.042     | 1.31± 0.26      |
| MSSQ2 Buses or Coaches                       | 0.00± 0.015     | 0.35 ± 0.09     | 0.17± 0.18      | 0.62± 0.13      |

Coelho et al., *Dizziness and vertigo*
The Motion Sickness composite scores were significantly lower (Gomes-Howell tests, p<0.01) for Thai-males (0.74 ± 0.78 SE) than for females of either Thai (3.80 ± 0.42 SE) or Chinese (2.33 ± 0.60 SE) ancestry. Scores for Chinese-males (2.42 ± 0.98 SE) were intermediate and did not differ significantly from the other groups. For item 2, Thai males reported being less symptomatic than either Thai females (p<0.01) or Chinese females (p<0.05) by Gomes-Howell tests.

The Thai Females had significantly higher ratings on the Albany Panic and Phobia Test than Chinese Females (p<0.05), but no other differences were significant. No group differences were observed on either the Body Symptoms Questionnaire or the Space and Motion Discomfort SitQ scores.

As expected, there was a significant correlation among item ratings that showed effects of gender and ancestry (Table 2). Because the Kaiser-Meyer-Olkin measure (sampling adequacy) was 0.717 and the Bartlett sphericity test was significant (equivalent χ²(10)=1026.7, p<0.001) across these five item responses, a principal components factor analysis (varimax rotation with Kaiser normalization) was performed. Two components were identified that explained 67% of the total variance (Table 3). Component 1 reflects common aspects underlying responses to the five Fear of Heights items (same polarity and magnitude), with negligible influence of the MSQ item. Component 2 is dominated by the MSQ item, with subtle interactive, differential effects of the Fear of Heights items. Component 1 (Table 4) was significantly lower for both females of Thai ancestry than for females of Chinese ancestry (Games-Howell tests, p<0.01). For Component 2 (Table 4), the female groups had greater scores than the male group, regardless of ancestry.

Several of these related disorders highly correlate between each other. Motion Sickness correlates with Panic (0.380, p <0.001), Body Symptoms (0.223, p <0.001)

Table 2. Pearson Correlation Coefficients Between Questionnaire Items in Table 1. Italic font for Thai Ancestry, Normal font for Chinese Ancestry; Bold font for all subjects

<table>
<thead>
<tr>
<th></th>
<th>FH8</th>
<th>FH15</th>
<th>FH18</th>
<th>FH20</th>
<th>MSQ2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FH8 Airplane trip</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>FH15 Standing on the edge of a subway platform</td>
<td>.429**</td>
<td>.416**</td>
<td>.497**</td>
<td>.399**</td>
<td>.027</td>
</tr>
<tr>
<td>FH18 Riding an elevator to the 50th floor</td>
<td>.690**</td>
<td>.586*</td>
<td>.521**</td>
<td>.623</td>
<td>.604*</td>
</tr>
<tr>
<td>FH20 Walking up the gangplank of an ocean liner</td>
<td>.270</td>
<td>.171</td>
<td>.327</td>
<td>.402*</td>
<td>.452**</td>
</tr>
<tr>
<td>MSSQ2 Buses or Coaches</td>
<td>-.118</td>
<td>-.094</td>
<td>-.043</td>
<td>-.193</td>
<td>-.171</td>
</tr>
</tbody>
</table>

Table 3. Rotated Principal Component Loadings and Percent Variance Explained (Principal components factor analysis using varimax rotation with Kaiser normalization)

<table>
<thead>
<tr>
<th></th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FH8 Airplane trip</strong></td>
<td>0.669</td>
<td>-0.153</td>
</tr>
<tr>
<td>FH15 Standing on the edge of a subway platform</td>
<td>0.807</td>
<td>0.169</td>
</tr>
<tr>
<td>FH18 Riding an elevator to the 50th floor</td>
<td>0.781</td>
<td>-0.201</td>
</tr>
<tr>
<td>FH20 Walking up the gangplank of an ocean liner</td>
<td>0.778</td>
<td>0.167</td>
</tr>
<tr>
<td>MSSQ2 Buses or Coaches</td>
<td>-0.005</td>
<td>0.963</td>
</tr>
<tr>
<td><strong>Variance Explained</strong></td>
<td>46.31%</td>
<td>20.94%</td>
</tr>
</tbody>
</table>
and Space and Motion Discomfort (0.543, p<0.001). Fear of heights is highly correlated with Panic (0.469, p <0.001), Body Symptoms (0.339, p <0.001) and Space and Motion Discomfort (0.306, p <0.001). Panic correlates with Body Symptoms (0.525, p <0.001), and Space and Motion Discomfort (0.498, P<0.001). Interestingly, fear of heights does not correlate with motion sickness (0.066, P=128).

**DISCUSSION**

The responses from individuals of Thai and mixed Thai/Chinese recent ancestry suggested interactions between gender and ethnicity in some balance and dizziness symptom perception domains. Other domains, such as the Body Symptoms scale and the Space and Motion Discomfort scale, showed no significant differences as a function of either gender or ethnicity. These results seem to show that the two ethnic populations are similar in their self-reporting of vulnerability to motion sickness. Motion Sickness severity was reported as lowest in Thai-males, but did not differ significantly from Chinese-males.

The fear of heights scale showed a very strong interaction effect between gender and ancestry, with females of Thai-Thai ancestry howing much higher scores than females of Thai-Chinese ancestry. Because the males had intermediate scores and the number of females greatly outnumbered the number of males in each ancestry group, the difference among the female subjects was sufficient to produce a significantly different main effect for the Thai/Chinese group versus the Thai-Thai ancestry group. Inspection of the responses to individual items shows that these group differences can be explained mainly by responses to four items: Airplane trip; Standing on the edge of a subway platform; Riding an elevator to the 50th floor; Walking up the gangplank of an ocean liner (Table 1).

Almost all of the item by item responses by females were greater for Thai-Thai compared to Thai-Chinese subjects. Only item 4 (being upstairs on a ladder on the 2nd floor) showed less fear for Thai-Thai versus Thai-Chinese women. The items that show a more significant difference involve situations often associated with urban environments, namely 1) **Item 1**: Diving off the low board at a swimming pool; 2) **Item 3**: Looking down a circular stairway from several flights up; 3) **Item 5**: Sitting in the front of the second balcony of a theatre; 4) **Item 8**: Airplane trip; 5) **Item 10**: Walking on a footbridge over a highway; 6) **Item 13**: Seeing window washers ten flights up on a scaffold; 7) **Item 15**: Standing on the edge of a subway platform; 8) item 17: On the roof of a ten-story apartment building; 9) **Item 18**: Riding an elevator to the 50th floor; 9) **Item 20**: Walking up the gangplank of an ocean liner.

<table>
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<tr>
<th>Table 4. Principal component scores across groups</th>
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</thead>
<tbody>
<tr>
<td><strong>Mean ± Standard Error</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Component 1</td>
</tr>
<tr>
<td>Component 2</td>
</tr>
</tbody>
</table>
The items that are show a smaller difference are related to either natural environment, namely: 1) item 4: Standing on a ladder leaning against a house, second story and 2) item 7: Walking up a steep incline in country hiking; or situations with smaller or average differences are mainly related to situations that elicit low fear, such as 1) item 9: Standing next to an open window on the third floor; 2) item 19: Standing on a chair to get something off a shelf.

One possible confounded variable in fear of heights might be the dissimilar experience with potentially fear-evoking situations between groups. Individuals in the Thai/Chinese group are mainly lifetime residents of the city, whereas the Thai group comes from the surroundings were children have less contact with features of the urban environment, such as tall buildings, airplanes, boats, elevators, and subways. A by-product of the urbanization process has been a disproportionate concentration of these facilities in Bangkok. For example, among the 50 listed buildings in Thailand with at least 50 floors, 43 are in Bangkok and 7 are in Pattaya; a similar preponderance for Bangkok is reported for the 171 buildings listed as having more than 30 floors. Most University students from Thai-Chinese families reside in Bangkok, whereas the Thai-Thai group is mainly originated from rural areas or other less urbanized cities in Thailand. However, this consideration does not provide a rationale for the interaction effects between ancestry and gender responses to items related to fear of heights.

Results also point to the likelihood that fear of heights might be situation specific and treatment planning should involve several real or virtual exposures to a variety of different situations related to heights. In this line of inquiry, it would be interesting to explore what amount and kind of visual-vestibular challenges imposed by the circumstances specified in the fear of heights questionnaire.

Although fear of heights is likely a biologically „prepared“ fear according to Seligman’s (1971) account, the constant exposure to situations related to heights seems to have contributed to lower participant’s natural fears due to habituation. People gradually obtain the required abilities to deal with their current predisposed fears through habituation and experience (Rachman, 2002), and the environment can work, therefore, toward eliminating biologically relevant fears (Coelho & Purkis, 2009).

We know that perceptual, postural, and eye-movement responses to sensory patterns habituate to repeated stimuli and adaptto rearranged sensory signals (see Coelho & Balaban, 2015). Considering that Motion Sickness, Body Symptoms and Space and Motion Discomfort do not significantly differ between Thai and Thai/Chinese groups, the data suggest that the differences between groups are primarily responses to fear of heights items. Hence, despite similar motion sickness physiological responses, the experience relative to fear of heights is situationally specific and may not generalize.

The interpretation of this study is limited by the fact that it is based upon self-reports via printed questionnaires. For example, Klosterhalfen and colleagues (2006) found discrepancies between the subjective measures of motion sickness susceptibility and the behavioral ones in the Asian population. This was thought
to indicate that the native Chinese speakers could be less aware of their vulnerability to motion sickness. Nonetheless, the additional similarities between groups in other related measures (Body Symptoms Questionnaire and Space and motion Discomfort) results suggest that Thai and Thai-Chinese groups are likely identical relatively to their vulnerability to motion sickness.

Although it has been suggested that people of Chinese heritage tend to emphasize somatic symptoms, versus a ‘Western’ tendency to emphasize psychological terms (e.g., Dere et al., 2013, Ryder et al., 2008), our findings provide a caution against over-simplification of what are likely to be complex, multifactor effects. For example, higher fear (and panic) scores of the Thai-Thai females relative to females of Chinese origin suggests that they have greater tendency to somatise some of these symptoms. A similar conclusion was suggested for somatic symptoms of anxiety (Zhou et al., 2011). However, a study from the United States found that the degree of acculturation also has an effect on the number of reported of physical symptoms (Bauer, Chen & Alegria, 2012). Hence, it is possible that the higher fear and panic scores observed here might be secondary to contemporary rural-to-urban migration patterns and the urbanization process. These types of changes are known to impose social, economic and cultural challenges which might have on its own increased the general levels of anxiety of this subgroup, leading to the observed reports.

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