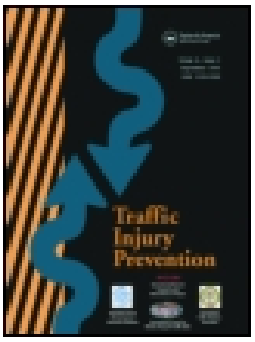

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Hazard perception of stroke drivers in a video-based Japanese hazard perception task

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ABSTRACT

Objective: Hazard perception (HP) is the ability to identify a hazardous situation while driving. Though HP has been well studied among neurologically intact populations, little is known about the HP of neurologically impaired populations (in this study, stroke patients). The purpose of this study is, first, to investigate the HP of stroke patients and, second, to verify the effect of lesion side (right or left hemisphere) on HP, from the viewpoint of hazard types.

Methods: Sixty-seven neurologically intact age-matched older drivers and 63 stroke patients with valid driver's licenses conducted a video-based Japanese HP task. Participants were asked to indicate the hazardous events in the driving scenario. These events were classified into 3 types: (1) behavioral prediction hazards (BP), which are those where the cause is visible before it becomes a hazard; (2) environmental prediction hazards (EP), which are those where the ultimate hazard may be hidden from view; and (3) dividing and focusing attention hazards (DF), which are those where there is more than one potential hazard to monitor on approach. Participants also took part in the Trail Making Test (TMT) to evaluate visual information processing speed.

Results: The results showed that the number of responses was significantly fewer for stroke patients than for age-matched drivers for all hazard types ($P < .001$), and this difference was not affected by lesion side ($P > .05$). It was also found that stroke patients showed a slower response time than age-matched drivers only for BP ($P < .001$). The lesion side did not affect response latency ($P > .05$). Results of the TMT revealed that age-matched drivers completed the task significantly faster than stroke patients ($P < .001$) and that neither TMT-A nor TMT-B differentiated between patients with left hemisphere damage and patients with right hemisphere damage ($P > .05$).

Conclusions: Firstly, HP in stroke patients is low compared to age-matched drivers. Secondly, even if stroke patients notice hazards, their response may be delayed in a BP situation, due to a slower visual information processing speed. Thirdly, the lesion side does not appear to affect HP.

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Vehicle driving; stroke; hazard perception; processing speed

Introduction

Disability can be a factor in vehicular accidents. Thus, identifying factors in vehicular accidents attributable to disability is significant from a prevention perspective.

One of the most important abilities required to prevent vehicular accidents is hazard perception (HP). Borowsky et al. (2010, p. 1240) and Wetton et al. (2011, p. 1232) defined HP as "the ability to identify hazardous/dangerous situations while driving." HP is frequently measured by having participants watch a video, filmed on the road, containing several potential hazards and asking them to indicate any developing hazards. This experimental HP paradigm has been known to demonstrate the impact of the level of driving experience on HP. Finn and Bragg (1986) reported that compared to experienced drivers, novices are less likely to notice potential hazards. This difference is attributed to the fact that once drivers have faced a dangerous on-road situation, they are more perceptive to danger in similar driving situations (Borowsky et al. 2010). This finding has been supported by various later studies (e.g., Armsby et al. 1989; Borowsky et al. 2010; Crundall 2016; Underwood et al. 2005). Furthermore, novice drivers' HP tends to be affected by time of day (Renge 1998) and sleepiness (Smith et al. 2009).

Though there have been reports that the level of driving experience does not affect response latency in HP tests (Crundall et al. 1999; Sagberg and Bjornskau 2006), many studies have suggested that HP is strongly affected by the level of driving experience. For example, novice drivers have a lower response latency for hazardous events than their experienced counterparts (McKenna et al. 2006; Scialfa et al.

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2011; Wallis and Horswill 2007; Wetton et al. 2010). It has been also reported that response speed slows with age even for experienced drivers (Bromberg et al. 2012; Horswill et al. 2008). Borowsky and Oron-Gilad (2013) have stated that professional drivers (e.g., taxi drivers) had higher HP than nonprofessional experienced drivers. In addition to the correlation between the level of driving experience and HP, a correlation between the types of hazardous events and HP has been revealed (Borowsky and Oron-Gilad 2013; Borowsky et al. 2010; Crundall et al. 2010). For example, Borowsky et al. (2010) reported that young, inexperienced drivers do not notice potential hazards. Furthermore, Crundall et al. (2010) stated that although awareness of visible hazardous events can be increased by commentary training, awareness of hidden hazardous events is difficult to increase in this manner. They thus speculate that awareness of hidden hazardous events is accumulated through experience.

In addition to the above studies on neurologically intact populations, studies on stroke patients have explored the cognitive functions necessary for safe automobile driving. Such studies are conducted because it is necessary to appraise the automobile driving ability of stroke patients in a reductionist manner in order for doctors to ascertain whether they will be able to drive again or to conduct treatment intervention for specific cognitive dysfunctions. A series of reports in this field includes those on visual searching ability (Alexandersen et al. 2009), visual information processing speed (Braga et al. 2018; Sommer et al. 2010), visuospatial recognition (Dawson et al. 2009), general intelligence (Joseph et al. 2014), executive function (Motta et al. 2014), knowledge of road signs, and nonverbal reasoning ability (Radford and Lincoln 2004). Therefore, a patient's on-road driving ability can be predicted to an extent (Lincoln et al. 2006, 2010; Lundberg et al. 2003; Nouri and Lincoln 1992).

Reports on behavioral characteristics of stroke patients have demonstrated that confidence in driving increases with driving duration after driving is recommenced (McNamara et al. 2015); recommencing driving is more difficult for patients with right hemisphere damage than for patients with left hemisphere damage (Fisk et al. 2002; Korner-Bitensky et al. 2000); simple left/right turns are possible but complex left/right turns (e.g., making a left/right turn while paying attention to the space between one's own vehicle and those up ahead) are difficult (Hird et al. 2015); and ascertaining road conditions and lane changes is difficult (Devos et al. 2014).

Together, these studies demonstrate the deleterious effects that stroke can have on basic driving abilities, all of which may impinge on HP ability. Despite this, a direct measure of HP skill has not yet been directly investigated. Here, we investigate HP in stroke patients and verify the effect of lesion side from the viewpoint of hazard types. Taking into account that 30–50% of stroke patients resume driving (Fisk et al. 1997, 2002; Heikkila et al. 1999), elucidating their HP can provide better assistance to patients as well as improve road conditions.

Methods

Participants

Sixty-seven neurologically intact licensed drivers (32 men, mean age = 67.2 ± 4.8 years) were included as a control group. The mean Mini-Mental State Examination (MMSE) score (Folstein et al. 1975) as a measure of cognitive function (the full score is 30 points and higher scores indicate higher cognitive ability) was 28.6 points (SD = 1.6, range 23–30). Participants' levels of driving experience were as follows: 52 participants had held a license for more than 40 years, 7 had held a license for between 30 and 39 years, and 8 had held a license for between 20 and 29 years. In addition, 53 participants reported driving every day, 10 reported driving once every 2–3 days, and 4 reported driving once a week.

Sixty-three stroke patients (51 men, mean age = 66.4 ± 10.2 years) who possessed driver's licenses and wished to resume driving were included in this study. At the time of the study, the mean months from stroke onset was 5.3 ± 15.7 months. The mean score of the Functional Independence Measure (FIM), which is a measure of how independently one can engage in daily activities such as walking and putting on/taking off clothes, was 110.4 points (SD = 12.3, range 73–126; the full score is 126 points and higher scores represent greater independence). The mean MMSE score was 25.9 points (SD = 4.3, range 19–30). The mean score of the Hasegawa Dementia Rating Scale–Revised (HDS-R) was 24.8 points (SD = 4.6, range 12–30; the full score is 30 points and higher scores mean greater cognitive ability). The HDS-R has been used as a dementia screening test in Japan and is comparable to the MMSE for screening for cognitive impairment in stroke patients. Twenty-nine patients had a left hemisphere lesion, 19 had a right hemisphere lesion, and the remaining 15 had lesions in both hemispheres. The clinical data show that the patients in this study suffered comparatively mild strokes.

Welch's *t*-test revealed that there were no statistical differences in age between age-matched drivers and stroke patients ($P = .56$). No statistical difference in age was found between patients with left hemisphere damage and patients with right hemisphere damage by *t*-test ($P = .48$). Though there was no significant difference in gender ratio for age-matched drivers group, $\chi^2(1) = 0.24$, $P = .63$, there were more males than females in the stroke patients group, $\chi^2(1) = 22.9$, $P < .01$. Stroke patients had lower MMSE scores than age-matched drivers ($P < .01$. All participants met the criteria for visual fields, eyesight, hearing, and physical function required to drive in Japan. Participant characteristics are summarized in Table 1.

All participants were informed of the study procedure verbally and in writing and provided their consent to participate. The study was carried out after obtaining approval from the medical research ethics committee of Hokkaido Chitose College of Rehabilitation (approval no. 17001).

Definition of HP and classification of hazards

In this study, HP was defined as "the ability to read road conditions and detect or predict events that may lead to a

Table 1. Characteristics of participants.

	Control	Stroke			
		All	Left hemisphere damage	Right hemisphere damage	Others
Number of participants	67	63	29	19	15
Sex (male/female)	32/35	51/12	24/5	14/5	13/2
Age (years), mean ± SD	67.2 ± 4.8	66.4 ± 10.2	66.4 ± 9.6	63.8 ± 11.7	70.5 ± 8.5
MMSE score (/30), mean ± SD	28.6 ± 1.6	25.9 ± 4.3	27.3 ± 2.5	26.0 ± 2.4	25.0 ± 4.2
HDS-R score (/30), mean ± SD	—	24.8 ± 4.6	25.2 ± 4.7	26.8 ± 2.3	22.3 ± 5.2
Months from onset, mean ± SD	—	5.3 ± 15.7	7.4 ± 22.1	4.5 ± 8.6	2.1 ± 1.6
FIM score (/126), mean ± SD	—	110.4 ± 12.3	110.2 ± 14.8	110.6 ± 10.9	110.5 ± 9.0

MMSE, Mini Mental State Examination; HDS-R, Revised Hasegawa's Dementia Scale; FIM, Functional Independence Measure.

collision with people, objects, or cars." Furthermore, hazard types were categorized into 3 classes (Crundall et al. 2010, 2012). Behavioral prediction hazards (BP) are those where the cause is visible before it becomes a hazard. In other words, the hazard and its precursor are the same road user—for example, a pedestrian (precursor)—who suddenly becomes the hazard. BP is thought to require visual information processing speed to notice oncoming traffic information while driving. Environmental prediction hazards (EP) are those where the ultimate hazard may initially be hidden from view (e.g., a pedestrian emerging onto the road from behind a parked vehicle). EP is thought to require the ability to estimate the probability of where hazards might come from on the basis of currently available visual information. Dividing and focusing attention hazards (DF) are those where there is more than one potential hazard to monitor on approach. DF is thought to require attentional capacity.

HP scenario

The authors recorded actual driving footage using a drive recorder (PaParazzi, Venture Craft Inc.). Hazardous events were extracted from the footage and edited to create a driving scenario. Scenario editing was conducted with Movie Writer 2010 Pro (Corel Inc.). The scenario included 8 clips: 4 from urban areas and 4 from residential areas. The length of the completed scenario was approximately 2 min, with a clip duration of 10 to 25 s. Each clip included a scene requiring HP, with 10 planned hazards in total. For example, clip_1 is a scene where a car drives straight on a road with housing and supermarkets along the roadside, which includes EP hazard with the possibility of people emerging from the roadside. Clip_2 is a scene where a car drives straight through a main street or an intersection, which also includes DF hazard with a car approaching, a stopped bus starting again, and a car intending to move. Clip_8 is a scene where there is a bicycle on the left-hand side waiting for the traffic light in the same direction as the driver, which includes BP hazard with a bicycle entering the driver's lane. Details are described in Appendix 1 (see online supplement).

HP task

To verify the participants' HP, they were asked to indicate the scenes in which hazards were detected or predicted in the 2-min driving scenario. They were required to touch the screen of the touch panel–type laptop (CF-C1B; Panasonic Corporation, Japan) when they identified scenes in which a risk was predicted. The video was paused at the touch of the screen. At that point, they were asked to give a verbal free response about what the driver should be aware of and their responses were recorded on the PC by the author. When the screen was touched again, the driving scenario resumed. The participants' responses, as well as the time stamps, were saved on the PC. The video-based HP task was programmed by Nishizawa Electric Meters Manufacturing Co.

Visual searching task

The Trail Making Test (TMT), consisting of Part A (TMT-A) and Part B (TMT-B), was conducted to assess participants' visual information processing abilities (Mazer et al. 2003). In TMT-A, participants were asked to touch, in order, the numbers 1 to 25 displayed on the PC screen. In TMT-B, participants were asked to alternately touch the numbers 1 to 13 and the Japanese *Hiragana* letters from あ to し displayed on the PC screen (e.g., 1, あ, 2, い, 3, etc.). The displayed target did not disappear from the screen even after a correct target had been touched. The time taken to complete the task was recorded on the PC. As with the video-based HP task, this was programmed by Nishizawa Electric Meters Manufacturing Co.

Results

Planned hazards and hazardous events noted by the participants

Participants' responses are summarized in Appendix 2 (see online supplement). The 10 planned hazards were identified as hazardous events by the participants. Response frequency ranged from 4.6 to 70%. Six additional hazardous events were identified (h_2, h_3, h_8, h_10, h_11, and h_13 in Appendix 2). H_2 and h_8 were classified as BP, h_3 was classified as DF, and h_10, h_11, and h_13 were classified as EP. The hazard types included in the scenario included 8 BPs with Cronbach's alpha of .7, 6 EPs with alpha of .3, and 2 DFs with alpha of .3 (Appendix 2).

Response to hazardous events

To reveal the difference in response frequency, 2 × 2 chi-square was administered between age-matched drivers and stroke patients. Analysis revealed that the response frequency of age-matched drivers was significantly higher for all hazardous events except h_1, χ^2 (1) = 2.7, P = .1), h_6, $\chi^2(1)$ = 1.4, P = .24, h_8, $\chi^2(1)$ = 0.006, P = .94, h_10, $\chi^2(1)$ = 0.05, P = .82), h_11, $\chi^2(1)$ = 1.77, P = .18, and h_13, $\chi^2(1) = 0.09$, P = .76 (Appendix 2). Then, to elucidate the effect of each hazard type, we compared the number of responses between age-matched drivers and stroke patients. A 2-way analysis of variance was applied to the number of responses in the 2 factors (Subjects × Hazard types). Analysis revealed that a main effect was found for both subjects, F(1, 96) = 70.3, $P < .01$, and hazard types, F(2, 228) = 167.3, $P < .01$; however, the main effects was qualified by significant interaction between the 2 main factors, F(2, 13) = 9.9, $P < .01$. Bonferroni correction was applied to verify the difference between age-matched drivers and stroke patients for hazard types. Results revealed that age-matched drivers indicated more hazards than stroke patients for all hazard types ($P < .01$; Figure 1a). Next, we compared the number of responses between patients with left hemisphere damage and patients with right hemisphere damage. The 2-way analysis of variance revealed that the interaction for main 2 factors (Damaged side × Hazard types), F(2, 1.0) = 0.85, P = .43, and main effect of damaged side, F(1, 3) = 2.3, P = .13, was not significant, though a statistically significant main effect of hazard types was evident, F(2, 53) = 44.7, $P < .01$. Bonferroni correction revealed no significant difference between patients with left hemisphere damage and patients with right hemisphere damage ($P < .05$ for all hazard types; Figure 1b).

Based on the previous findings that response latency in the HP paradigm differs among subject groups (Crundall 2016; Egea-Caparros et al. 2016), we measured the response latency using the time (seconds) within the scenarios. The *z*-scores of response latency for each hazardous event were used as variables for the comparisons. A positive *z*-score represents a slower response and a negative value represents a faster response. The same statistical analysis was applied for response frequency. Stroke patients showed a significantly slower response only for BP (Bonferroni correction, $P < .01$; Figure 2a). No statistically significant difference emerged between patients with left hemisphere damage and patients with right hemisphere damage for either hazard type (Bonferroni correction, P = .55 for BP, P = .69 for EP, and P = .3 for DF; Figure 2b).

Visual searching ability (TMT)

Though Welch's *t*-test revealed that the time taken in the TMT was significantly longer for stroke patients, t (59) = 3.7, $P < .001$ for TMT-A; t (88) = 4.9, $P < .001$ for TMT-B, than for age-matched drivers, neither TMT-A nor TMT-B differentiated between patients with left hemisphere damage and patients with right hemisphere damage.

Discussion

Following Wetton et al. (2011), the BP hazard score had an acceptable reliability (alpha of .7) with 8 hazardous events, indicating that this number of items was appropriate. However, the EP and DP hazard scores both had low reliabilities (alphas of .3), probably due to the lower number of items in these measures (6 and 3, respectively). This indicates that we cannot discount the possibility that there may be group differences for these hazard types but that our measures of hazard perception did not have sufficient reliability to detect them. The same number of hazardous events in each hazard type should be used for future analyses. We also found that response frequency ranged from 4.6 to 70%. This represents that the degree of risk differs from each scene. This tendency is supported by previous research (Benda and Hoyos 1983; Borowsky et al. 2010).

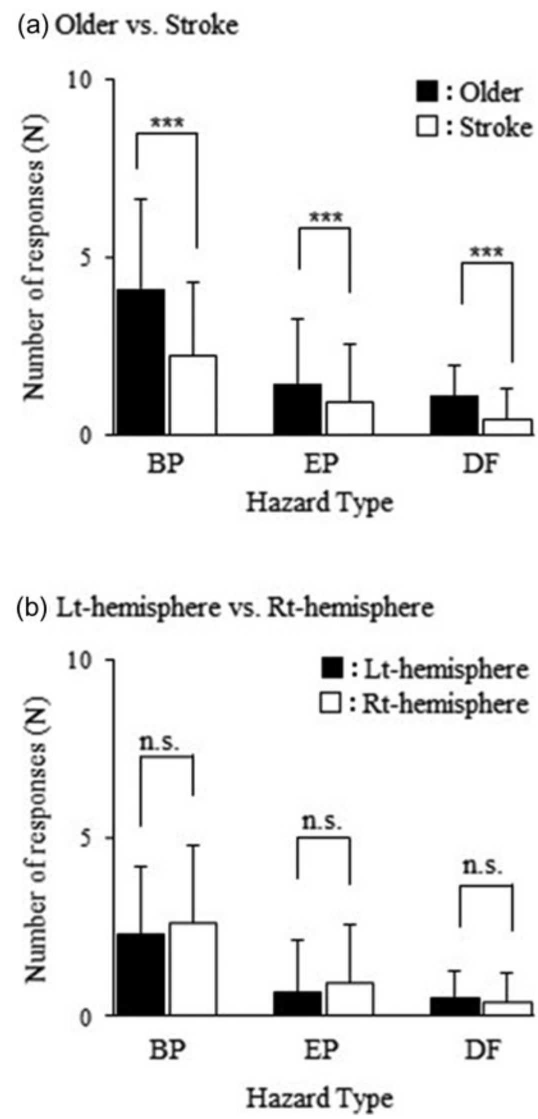

Figure 1. Differences in the number of responses between older and stroke patients (a), and between left/right hemisphere damaged patients (b). BP, Behavioral Prediction hazard; EP, Environmental Prediction hazard; DF, Dividing and Focusing Attention hazard; n.s., not significant; $*p < .05$, $**p < .01$, $***p < .001$.

The objective of this study was to elucidate the characteristics of HP in stroke patients. The first results showed that, on average, stroke patients had fewer responses than the age-matched drivers. It is widely accepted that a cognitive dysfunction that manifests among all stroke patients is a decline in visual information processing speed and capacity (Hurford et al. 2013; Su et al. 2015). These functional

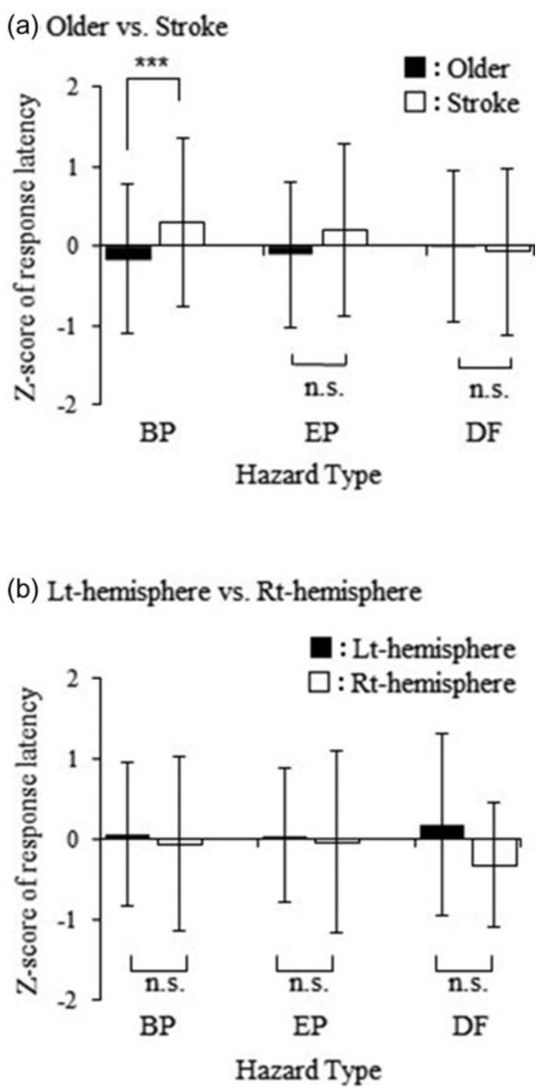

Figure 2. Differences in the response latency between older and stroke patients (a), and between left/right hemisphere damaged patients (b). Positive values represent slower response, vice versa. BP, Behavioral Prediction hazard; EP, Environmental Prediction hazard; DF, Dividing and Focusing Attention hazard; n.s., not significant; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

impairments are reported to correlate with on-road driving ability (Dawson et al. 2009; Schanke and Sundet 2000). Because in the HP paradigm the participants detect hazards while watching video footage, high visual information processing ability is a requirement. The paucity of the number of responses among stroke patients is thought to be attributable to the decline in visual information processing. There are 3 reasons that support this idea. The first is the significant delay in the TMT, which indicated the visual information processing ability among stroke patients. The next is based on the fact that the difference in hemisphere damaged did not affect response frequency. In other words, the lack of difference in response frequency depending on the hemisphere damaged allows for the inference that the effect of brain damage itself had manifested, rather than a disorder in either one of the hemispheric functions, impacting the result. The third reason is the age of the participants. Although it is well known that the level of driving experience impacts HP (Armsby et al. 1989; Borowsky et al. 2010; Finn and Bragg 1986; Underwood et al. 2005), there was no age difference between the age-matched drivers and stroke patients; as such, it can be inferred that there is no significant difference in the participants' levels of driving experience. Therefore, it is inferred that stroke patients had fewer responses because they were not able to process the constantly changing images appearing on the screen. In an actual driving setting, this delay would appear as an overlooked piece of important information, resulting in a heightened risk of accidents.

The second noteworthy result was that stroke patients had a significantly slower response only with regard to BP. The greatest difference between BP and EP is that situation-based hazards can be perceived in EP as long as stroke patients can read road conditions. In other words, their level of driving experience could compensate for the decline in visual information processing speed. This is similar to the idea of experienced drivers using compensatory driving strategies of slower driving to combat the decline in their abilities caused by aging (Bromberg et al. 2012). Thus, visual information processing ability becomes a necessity. In addition, the BP precursor needs to be visually detected. With regard to the difference between BP and DF, we believe that there should be several precursors to perceive a valid hazard in the latter, leading to a holistic assessment of the road situation from one of these precursors.

The third noteworthy finding was that lesion side affected neither number of responses nor response latency. We are conscious of the limitation resulting from the lack of patients who suffered severe stroke. However, it would be possible to infer that the hemisphere-associated symptoms were not severely manifested because, as the FIM and MMSE scores indicate, the participants in this study suffered comparatively mild strokes, leading to no significant hemispherical difference. Previous studies in which HP was not considered a measure of stroke patients' driving abilities have suggested that lesion side might affect HP. Such studies have indicated that patients with right hemisphere damage have difficulties resuming driving (Fisk et al. 2002; Korner-Bitensky et al. 2000); a simple left/right turn is possible but a complex left/right turn is difficult (Hird et al. 2015); ascertaining road conditions and changing lanes is difficult (Devos et al. 2014); and in cases where the lesion lies in the occipital or parietal lobe, those with right hemisphere damage will experience an impact on their driving technique (Devos et al. 2015). Therefore, it is necessary to examine HP depending on the cognitive dysfunction in stroke patients by severity level.

There are several limitations in this study. Firstly, the HP test is not capable of excluding the effect of subjective judgment regarding whether a given scene includes a hazard leading to an accident (Egea-Caparros et al. 2016). Secondly, a difference in gender ratio among stroke patients may have resulted in selection bias. Thirdly, the number of hazardous events in each hazard type was small, which may be why a significant difference was only found in BPs. Lastly, our sample size was not large enough to examine the impact of stroke severity on HP.

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Appendix 1. Situations and planned hazards in the scenario. BP, Behavioral Prediction hazard; EP, Environmental Prediction hazard; DF, Dividing and Focusing Attention hazard

Scenario	Frame (seconds)	Duration (seconds)	Environment	Situation	Planned hazards	Hazard Type
clip_1	0 – 10	10	Residential	A scene in which a car drives straight on a road with housing and supermarkets filling the roadsides. Many cars are moving at a slow speed in the opposite lane.	Possibility of people emerging from the roadside.	EP
clip_2	10 – 35	25	Urban	A scene where the car drives straight through a main street or an intersection.	A car approaching A stopped bus starting again A car intending to move	BP DF
clip_3	35 – 58	23	Urban	A scene where the car enters a major trunk road from a restaurant parking lot with many cars entering from the main trunk road into the parking lot.	A car entering the parking lot. A road sign	BP BP
clip_4	58 – 68	10	Urban	A scene involving a right turn at an intersection	Possibility of an oncoming car going straight	EP
clip_5	68 – 93	25	Residential	A scene in which the car is driving on a narrow road with many curves.	Possibility of people emerging from the roadside.	EP
clip_6	93 – 106	13	Residential	A scene involving a left turn at an intersection. There are no cars in front of the participants and there is good visibility	Possibility of pedestrians and bicycles coming from the left rear direction	EP
clip_7	106 – 120	14	Urban	A scene involving driving on a main road in front of a train station with many pedestrians and oncoming vehicles.	An oncoming car entering from the opposite lane.	BP
clip_8	120 -132	12	Residential	A scene where there is a bicycle on the left-hand side waiting for the traffic light in the same direction as the driver	A bicycle entering the participants' lane.	BP

Appendix 2. Participants' descriptions and response frequency of age-matched control and patients with stroke. BP, Behavioral Prediction hazard; EP, Environmental Prediction hazard; DF, Dividing and Focusing Attention hazard; n.s., not significant; * p < 0.05, ** p < 0.01, *** p < 0.001.

Hazard	Scene	Participants' response	Hazard Type	Response frequency (%)				
				ALL (N=130)	Control (N=67)	Stroke (N=63)	X^2 value	p value
h_1		Be careful about the possibility that a pedestrian or vehicle may suddenly appear from the roadside	EP	18.5%	23.9%	12.7%	2.7	n.s.
h_2		Be careful about the left-turning vehicle ahead	BP	31.5%	44.8%	17.5%	11.2	***
h_3		Be careful about the oncoming vehicle and the signal when entering an intersection	DF	19.2%	28.4%	9.5%	7.4	**
h_4		Be careful about the white vehicle approaching from the left side	BP	62.3%	73.1%	49.2%	7.9	**
h_5		Be careful about movement of the bus ahead on the left and the black car intending to move	DF	41.5%	46.3%	36.5%	28.1	***
h_6		Be careful about the approaching vehicle taking a wide turn	BP	70.0%	74.6%	65.1%	1.4	n.s.
h_7		Comply with the stop line and stop sign when entering a main road	BP	51.5%	62.7%	39.7%	6.9	**
h_8		Be careful about the possibility that the approaching white car may take a wide turn	BP	4.6%	4.5%	4.8%	0.01	n.s.
h_9		Be careful about the possibility that oncoming cars may appear when making a right turn at the intersection	EP	33.8%	41.8%	25.4%	3.9	*

h_10		Be careful about the possibility that pedestrians or bicycles may come from the right rear direction when making a right turn	EP	7.7%	9.0%	6.3%	0.1	n.s.
h_11		Be careful about the possibility that pedestrians or vehicles may suddenly appear from the roadside	EP	4.6%	1.5%	7.9%	1.8	n.s.
h_12		Be careful about the possibility that pedestrians may suddenly appear from the roadside	EP	62.3%	79.1%	44.4%	16.6	***
h_13		Be careful about the possibility that pedestrians or bicycles may come from the left rear direction when making a left turn	EP	5.4%	6.0%	4.8%	0.1	n.s.
h_14		Be careful about the pedestrian waiting in front of the crossing may come into the drivers’ lane	BP	15.4%	23.9%	6.3%	7.7	**
h_15		Be careful about the oncoming vehicle stopping past the centerline	BP	39.2%	53.7%	23.8%	12.2	***
h_16		Be careful about the bicycle entering the drivers’ lane	BP	58.5%	79.1%	36.5%	24.3	***