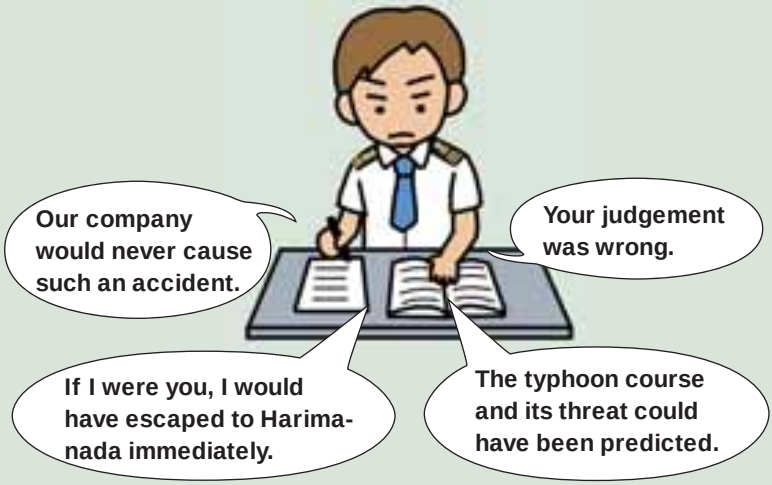
§ 4 Kansai Airport Connecting Bridge Damage
(Source: Japan Transport Safety Board Report)

We will now take a look at the oil tanker Vessel H's accident that damaged the connecting bridge at Kansai Airport during Typhoon No. 21 in September 2018.

Type of ship:	Oil tanker Vessel H
Gross tonnage:	2,591 tons
Type of accident:	Collisions (bridge)
Date and time of occurrence:	On the 4th of September 2018, at approximately 13:40 (JST)
Point of occurrence:	The connecting bridge to Kansai International Airport in Senshu port of Osaka Prefecture

After the occurrence of the accident, the lecturer who was in charge of accident prevention duties as a civil servant, received the following comments from various maritime involved parties: similar primary comments like these were heard following the typhoon's wind and flood damage of 2019.

This phenomenon can also clearly be psychological.



● Primary comments just after the accident show cognitive distortions.

From a psychological perspective, this is congruent with **"hindsight bias"** whereby human beings tend to criticize as an afterthought (the wisdom of hindsight).

＊ **Hindsight Bias**

The tendency to think that something was predictable, only after the event has occurred. A prediction recorded after the event (Retrospective Prediction).
The person who made this comment does not realize this bias is occurring.

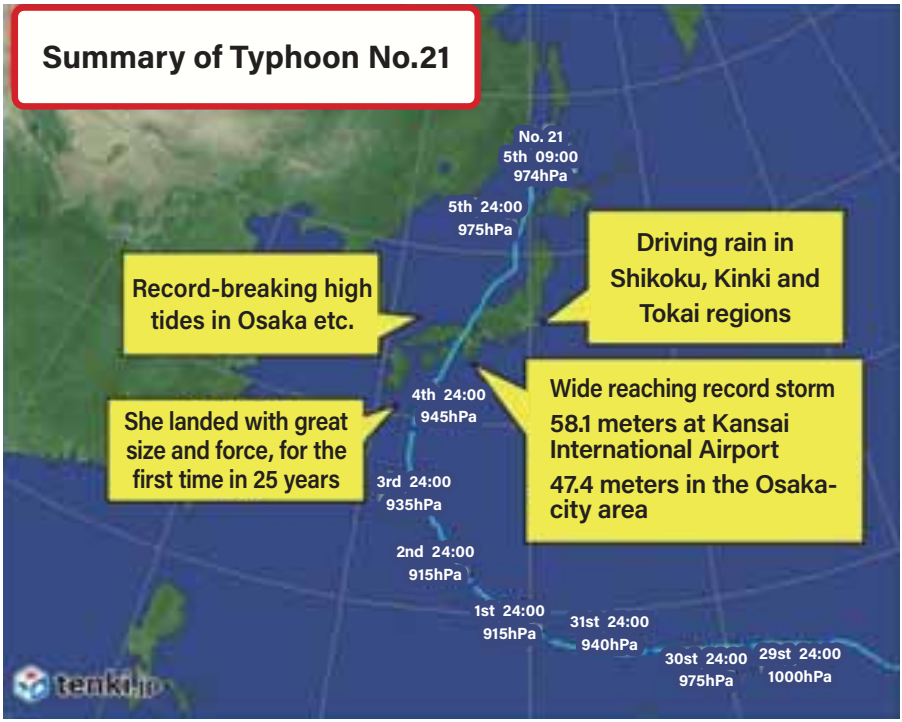
For example, please imagine this situation: A housewife was once very happy to get her new cloths for half-price at a bargain sale, however, she realized that the reason why the price was so cheap was simply because they were poor-quality products. She then protected and justified herself by saying "I thought that this was poor-quality because it was very cheap.
At this moment, it would not be wise for her husband to say, "I don't understand why you bought that if you knew this." Your words would not only be regarded as criticism of her self-preservation instinct, but also considered psychologically aggressive behaviour and your wife would be disappointed with your lack of affection.
However, this line of questioning can be useful for a "Why Why Analysis" that is carried out when analysing accidents.

4－1　Accident summary

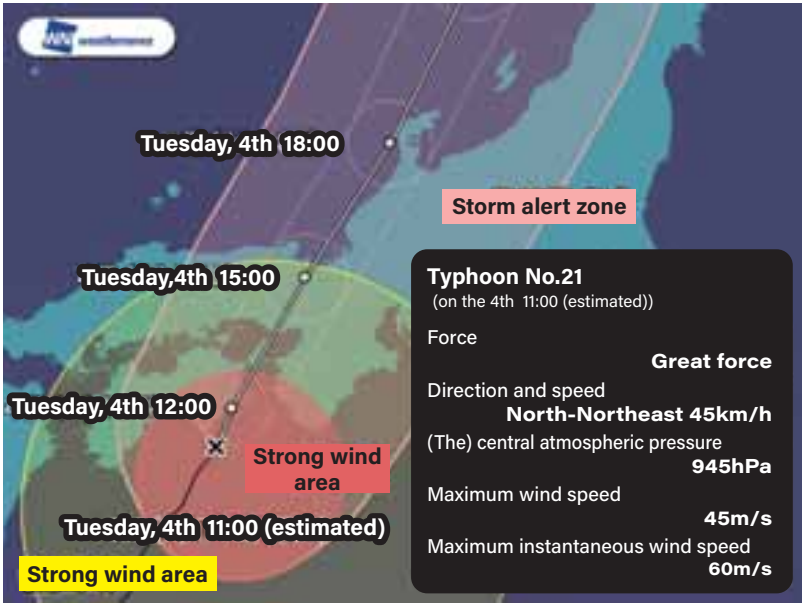
With Typhoon No.21 (Jebi) approaching, a typhoon warning had been issued for the Seto Inland Sea including Osaka Bay. The oil tanker Vessel H with its Master and 10 other crew members was anchored offshore, to the South East of Senshu Port. As the typhoon approached, the tanker was hit by increasingly strong winds and began to drag anchor causing it to drift northwards where it crashed into a bridge connecting Kansai

International Airport to the mainland at 13:40 on the 4th of September.

The deck of Vessel H's bow on the starboard side was crushed whilst the Kansai International Airport connecting bridge sustained bending, rupture and abrasion to one of the bridge's traffic girders. In addition, rails were twisted and overhead electric pylons collapsed on the railway girders, and a gas pipe was also ruptured. Despite this, none of the ship's crew suffered any casualties.



Photograph 7　Typhoon No. 21: Japan Weather Association



Photograph 8 Typhoon No. 21: Weathernews Inc.

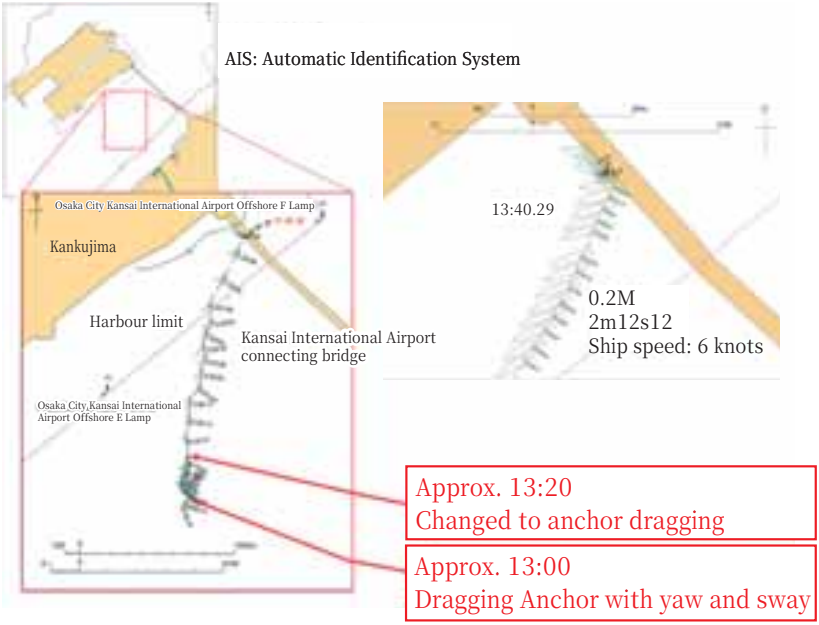
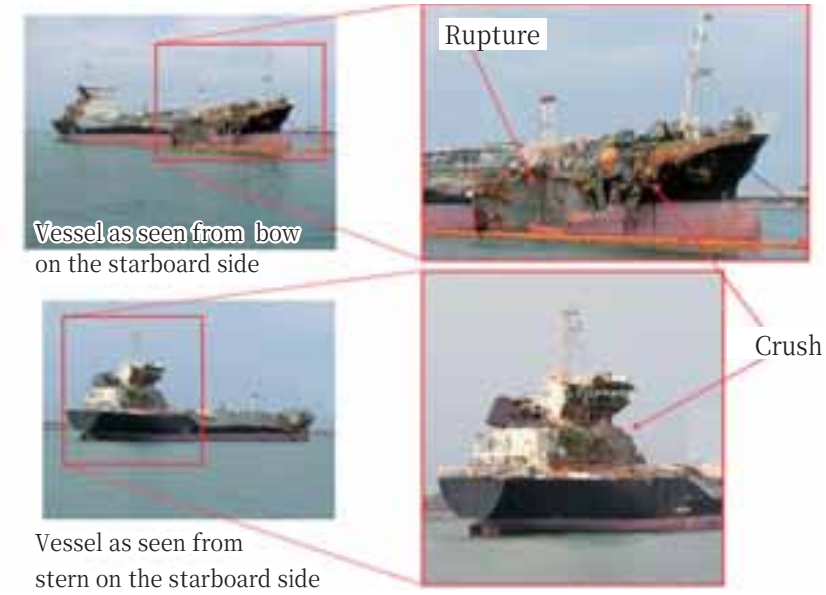
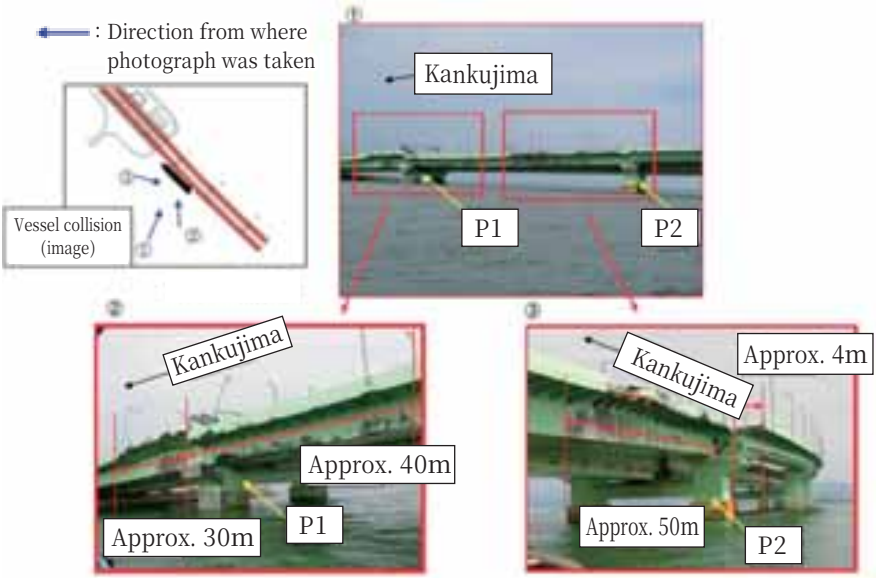


Fig. 9 Vessel H Track chart via AIS From Japan Transport Safety Board Report



Photograph 10　Damaged Vessel H　From Japan Transport Safety Board Report



Photograph 11　Kansai Airport Connecting Bridge Damage
From Japan Transport Safety Board Report

4－2 Psychological influence regarding the cause of the accident

(Extract from Japan Transport Safety Board Report)

The following is an extract from the Japan Transport Safety Board report. As shown below, the psychological factors that inform choices and the strong influences behind choices are highlighted in red.

(1) It is thought that the Master made his decision to take shelter from the typhoon and set anchor where he did due to his experience of having previously set anchor in the same location for similar purposes, and because he believed that Typhoon No.21 would pass to the east of this location. It is further considered that he based his decision on the choice of location upon the fact that he believed the typhoon would proceed rapidly and that they would not be exposed to strong winds for a prolonged period of time, that the anchor site was surrounded by land, that the muddy seabed would provide good anchorage, that other ships were also anchored there to take shelter, and that the next cargo loading was due to take place at Sakai Senboku Port in Hanshin Harbour. It is also believed that the Master made his decision unaware of the Loss Prevention Guide and the requirement that ships should avoid setting anchor within 3 nautical miles of Kanku Island.

(2) It is thought that the Master opted for a single anchor mooring due to his belief that when employing a two-anchor mooring, any change of wind direction could cause the anchor and anchor chain to become entangled and lead to a reduction in mooring power, and because when he had previously employed a single anchor mooring, he had been able to counter any typhoon winds by using the main engine.

(3) At approximately 12:30 with maximum instantaneous wind speeds

of more than 20 m/s, the Master advanced slow ahead using the main engine and placed the joystick in the hover position. It is thought that this was to counter any anchor drag.

(4) At 12:58:14, the starboard bow was hit by winds from a <016> direction with an estimated maximum instantaneous wind speed of 37.0 m/s. The course over the ground was <308.4> with a speed over the ground of approximately 0.9 kts. The vessel was facing leeward and mooring power was decreasing. It is thought that the anchor had already begun to drag by this point.

(5) At approximately 13:00, the Master confirmed via the ship 's radar that the ship was being brought to leeward towards Kanku Island. It is thought that he realised the anchor was dragging and moved the joystick to full speed ahead trying to steer the ship windward.

(6) At 13:10:14, with maximum instantaneous wind speeds from a <140> direction and average wind speeds from a <130> direction, and with a course over the ground of <063.5>, it is believed that the ship was brought under control by using the rudder and the main engine, that the ship was no longer facing leeward and that anchor dragging had been arrested.

(7) It is thought that the Master believed himself to have countered the anchor dragging since he had managed to stop the ship drifting by employing harbour full propeller rate.

(8) It is presumed that the Master believed anchor dragging to have stopped since the ship 's radar screen indicated a speed over the ground of " 0 " and this led him to set the joystick to the hover position causing propeller thrust power to dissipate and a loss of forward thrust.

(9) At 13:18:38, the forward bow was hit by maximum instantaneous wind speeds of 30.3 m/s and average wind speeds of 25.8 m/s with a course over the ground of <349.3> and a speed over the ground

of 1.3 kts causing the ship to be brought to leeward. It is thought that this was the start of the ship once again drifting leeward.

(10) After continually monitoring the ship 's radar, the Master realised that the ship was approaching Kansai International Airport connecting bridge and noticed that the ship had begun drifting leeward. It is thought that this was what led him to start sailing at full speed ahead on the main engine.

(11) The ship continued on a single anchor mooring. However, there was a lack of sea area on the leeward side, an increase of sea depth because of a storm surge which led to the anchor chain pulling away from the seabed and causing a reduction in mooring power, and an increase of wind pressure and wave drift forces acting upon the ship. It is presumed that the cumulative effect of these were to cause the anchor to drag and the ship to drift, leaving insufficient distance within which to regain control before crashing into the connecting bridge.

(12) It is supposed that the ship, without her main engine continuously employed, could not regain control and drifted due to the continuous wind pressure and wave drift forces exerted upon it.

(13) When taking refuge from a typhoon, in order to select the best spot to shelter, it is often necessary to consider adapting the voyage plan and chartering plan. It is thought that prior to the approach of Typhoon No. 21, had there been proper discussion between the Master, the ship owner, and the operator, a greater number of anchoring site options could have been revealed and the Master could have hence chosen a different site, thereby possibly avoiding this accident. Furthermore, B company's SMS stipulates that in the event of any possible threat to the safety of any shipping operations such as to the operation route, the harbour conditions, or any of the sea and land facilities, interim changes to the voyage plan or to the allocation of shipping should

be made following discussion between the Master, the ship owner and the operator.

4－3 Psychological explanation regarding weather judgement

The Master of Vessel H was thinking the following:

- Typhoon No.21 would move eastward of the anchorage.
- Very strong wind would not blow over a prolonged period of time.

At the time of the accident, the Master had obtained information about Typhoon No.21 through television, his PC, and tablet device etc. Also, the Master had received information on the typhoon prior to unberthing, and was aware that Typhoon No.21 was coming. On the Route Map, the anchorage was situated in the typhoon's right-side semicircle. However, looking at the weather chart, the Master believed that the typhoon would pass the east side of the anchoring point. This will be analysed from the viewpoint of the psychology, as follows:

Assumed course of the typhoon → Normalcy Bias

＊Normalcy Bias (Please refer to page 60 of the Loss Prevention Bulletin No.46, "Psychological Approach to Safety Behaviour".)

Human beings have the characteristic to underestimate or ignore information regarding him or herself. We tend to ignore negative information and underestimate phenomena saying, "I'm special, nothing can hurt me!" But this is because of cognitive distortions, which may delay our ability to escape from an imminent disaster.

According to the person in charge at Japan Weather Association or privatized weather forecasting companies, “It is understood that typhoons move on a diurnal course. Except for freak typhoons, they normally move in the same way as forecast 24 hours before.” The forecast at that time also predicted that the centre of a typhoon would pass on the west side of Kansai Airport. It was almost 100% certain that the vessel’s anchorage would fall in range of the “dangerous semicircle”. Influenced by other pressure, which will be described below, the Master believed that the typhoon was to pass the east side.

4－4 Psychological explanation regarding selecting of anchorage point and method

= Choice of anchorage point =

The Master selected the anchorage point based on the following:

- As both a navigation officer and a Master, he had previously selected the same area 2 or 3 times as a suitable place to shelter from a typhoon.
- After unloading was completed and prior to casting away from their berth on the 3rd of September, the Master obtained an update on Typhoon No.21. Despite the ship being within the danger zone of the expected path of the typhoon, after checking the weather charts the Master believed that it would pass to the east of his chosen point of anchor.
- The anchoring point was further selected for the following reasons: it was surrounded by land, offered a muddy seabed which would provide good anchorage. Other ships had anchored there to take shelter. The next cargo loading was scheduled to take place at Sakai Senboku Port in Hanshin Harbour.

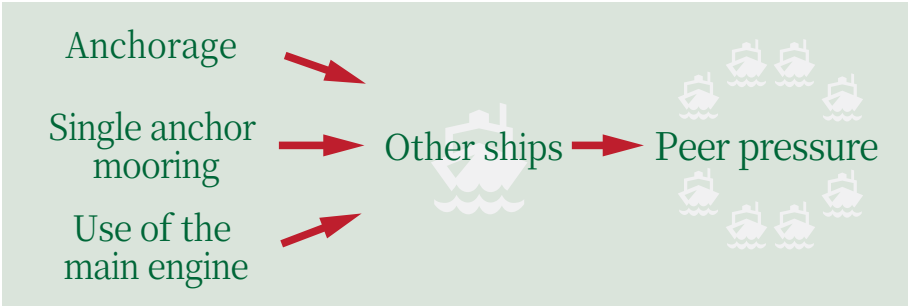
- The Master believed that Typhoon No.21 would pass to the east side of the anchorage and proceed rapidly thereby leaving the ship not exposed to strong winds for a prolonged period of time. He did not anticipate loss of control of the ship or any anchor dragging.

= Anchoring method =

The Master mentioned the reason as to why he settled for single anchor mooring as an anchoring method as follows:

- The Master understood the precautions on anchoring in rough weather in accordance with the company's safety control standards. With regard to two-anchor mooring, however, he assumed that the holding power of the anchor and cable would be reduced when the wind direction changed.

- Every time he conducted single anchor mooring in the past, he managed the wind of the typhoon by using the main engine.



The Master had a false sense of security because other ships were also carrying out single anchor mooring. It has been proved that unexpected results may occur, when psychological peer pressure and the above mentioned normalcy bias overlap.

＊Peer Pressure ((Please refer to page 59 of the Loss Prevention Bulletin No.46,“ Psychological Approach to Safety Behaviour ” .)
Human beings are prone to make a judgement or decision influenced by somebody else's ideas and thoughts.

In addition, it can be analysed that the following elements of psychology were contributing the Master's decision.

＊ Psychology of Successful Experience

The following experiences will help one recognize their own possibility, when performed effectively in given situations.

- Mastery experiences

  Factor including one's own experience, is one's own experience of achieving something or having won success.

- Vicarious experiences

  Observing others achieve something and winning success.

- Verbal persuasion

  When one receives verbal encouragement that he/she has the ability to achieve something.

- Emotional & Physiological States

  Being in high spirits with alcohol, drugs and other factors.

- Imaginal experiences

  Imagining visually oneself or other's successful experiences.

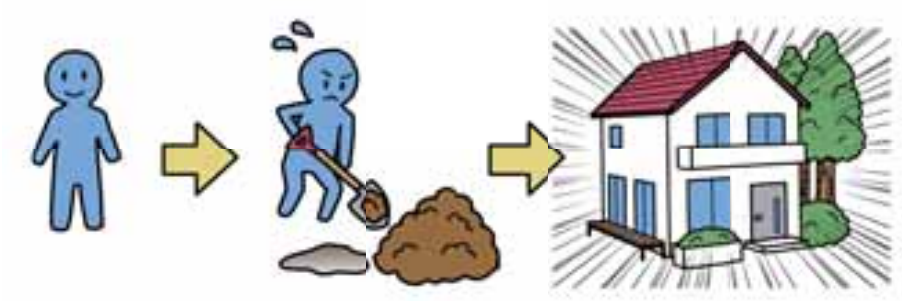


Fig. 12 Sense of achievement

Human beings feel a sense of achievement when seeing the favourable result of something that was anticipated. They are then spurred into action because of "efficacy expectation". Successful experiences reinforce confidence. When one says "I could do that then, [so I can do it now] " is a sign of confidence.

= Perceptual illusions =

The Master falsely believed the following points to be true because of perceptual illusions:

- The Master believed himself to have countered the anchor dragging since he had managed to stop the ship drifting by employing full speed ahead.
- He further believed anchor dragging to have ceased due to the radar screen which displayed a speed over the ground of ' 0 ' , hence leading him to set the joystick to the hover position. It is assumed that as a result of this, propeller thrust power was dissipated causing a loss of forward thrust.

The ship was equipped with a VecTwin Rudder.

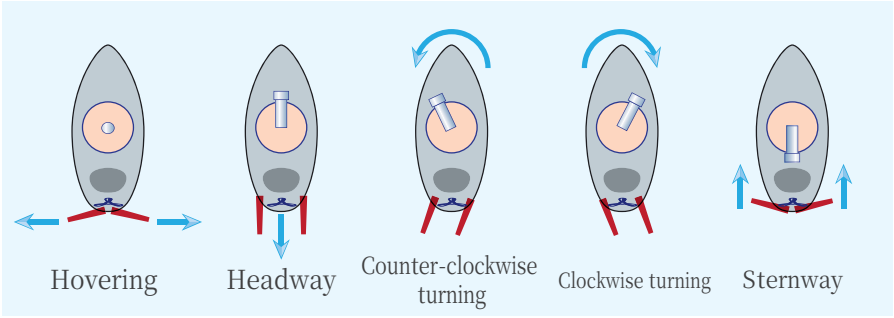


Fig. 13 VecTwin Rudder

At approximately 12:58 on the 4th of September, maximum instantaneous wind speeds reached 25.7 m/sec and anchor dragging began. At approximately 13:00, the Osaka Marine Traffic Information Service contacted the ship to inform her that she was dragging anchor. From this point, there was an attempt to manoeuvre the ship windward by employing full speed ahead which led to a speed over the ground of '0' being displayed on the radar screen. The Master was under the illusion that anchor dragging

had stopped. It is thought that in fact a mere balance between forward thrust and opposing drift speed had been obtained. At this point, the Master returned the joystick to the hover position.

＊ What are perceptual illusions?

For example, when we are waiting for a train to pass through and then it rushes past us, we would feel as if we are being pulled. Or when we are driving a car alongside a train at the same speed, we feel as if the train has stopped. There are also many optical illusions.

= Correct answer =

When casually looking at both pictures, the left picture appears to show a parent and his/her child, whereas the picture to the right may give you a sense of perspective that there is some distance between the two people.

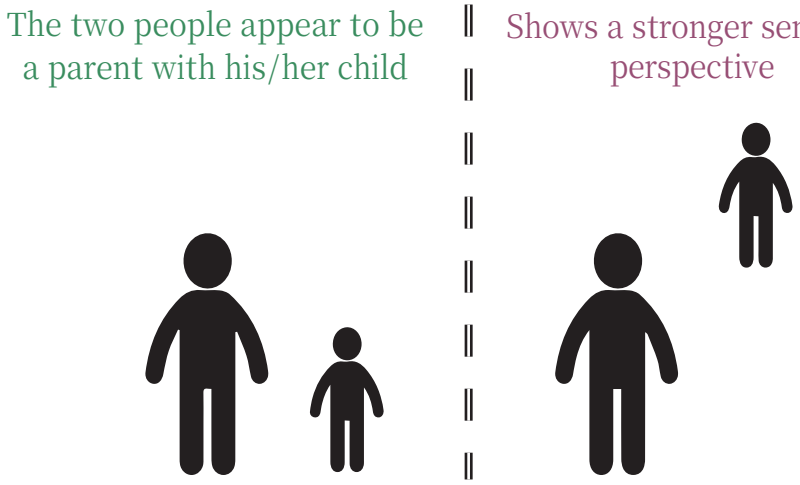


Fig. 14 Perceptual illusion

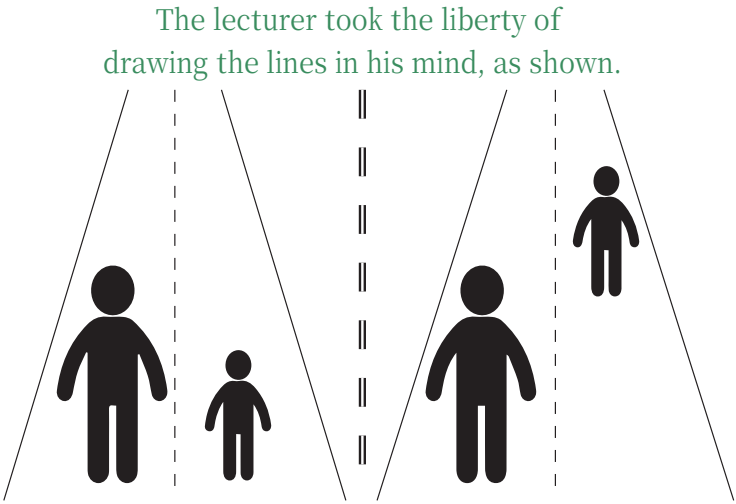


Fig. 15 Perceptual illusion

This is because he freely drew lines in his mind, as shown in Fig. 15.

Here we can see that it is difficult to imagine the lines, as shown in Fig.16. We learn that human beings face difficulty thinking differently about something once they have it set in their mind.

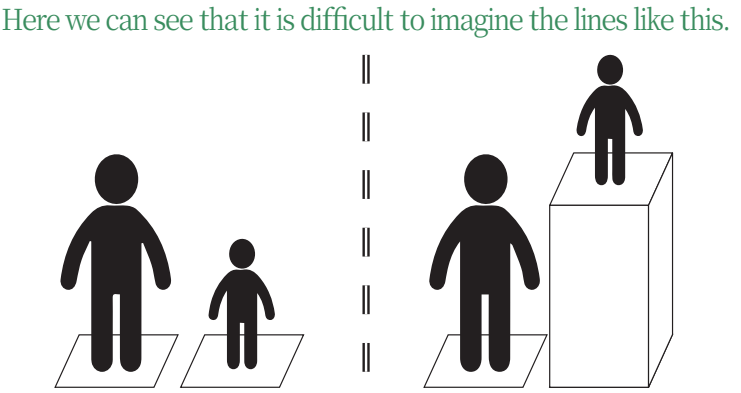


Fig. 16 Perceptual illusion

The brain actually knows that it is not a problem that we interpret something automatically or in an intuitive way in real life. However, it may mislead us to "misunderstand" something when we are faced with certain conditions as in Fig.16, something that we would not normally think intuitively about. According to human nature, the brain wants to save energy paying extra attention to something, and in the event that there are unanticipated conditions, a "perceptual illusion" is likely to occur caused by the gap between recognition and fact.

Imagine that you visually spot two different lights, one is bright and the other one is dark, when navigating during the night. With only visual information, we tend to believe that the ship with the bright light is closer to us and that the other with a dark light is in the distance. In fact, there would be a number of masters and navigation officers who have discovered that the ship with the dark light was in fact closer to their vessels, just because the power (level of wattage) of the other ship is unknown. Have you not had a tense moment like this finding it difficult to eliminate such an assumption?
It is important to always double-check by confirming the distance via radar, in order to reduce the amount of perceptual illusion error (human error).

"Human beings are not aware of the fact that they have no awareness of his/her own mannerisms or habits." (Provisional translation) This is one of the conclusions reached in this guide. The lecturer believes that it is essential to be aware of the various psychological distortions in order to enhance safety.

= Priming effect =

(How we can make the most of our memories and mindsets: using your brain more effectively From“ Brain Create ”)

Here is another pop quiz. Priming effect is a form of memory that is affected by prejudice, which means it “helps us to recognize something because we have an idea of what is beforehand. “Which means...??? If this this does not make any sense, then, in order to experience the priming effect first hand, please read the following words.

Carrot, Tomato, Cucamber, Cabbage

This quiz does not suggest that you memorize all of the above words. There is one word which is not recognized as part of the English language. Did you notice which it is? Which is not English? The answer is cucumber.

Most people strangely but actually correctly read this as cucumber (spinach). This is because cucumber is placed after two other vegetables in the group.
In this way, the phenomenon whereby the memory that you already have can be influential to this kind of occurrence is known as the priming effect. The reason why it is hard for you to recognise this typo by yourself is mainly because of this priming effect which made you biased. Thus, you can reduce these priming effect mistakes by letting others proofread for you.

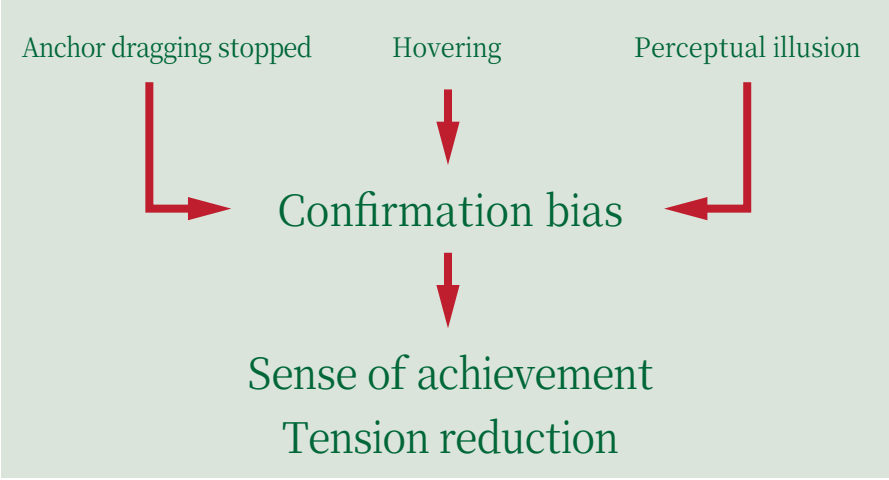
False recognition also stems from the same memory mechanism. Major mistakes which human beings tend to make can be a result of false recognition, but this is not always negative. Not being worried about small things, if you decide to take it easy, things may go smoothly many times.
False recognition may even sometimes make you draw an association with something irrelevant, which may bring you to an innovative idea. Priming effect as false recognition has survived brain evolution, and this could be a blissful message that being creative (which may be a hidden positive effect) is essential to the development of human beings.

= Limit of concentration =

- Believing anchor dragging to have been stopped, the Master set the joystick to the hover position.

Wind speeds exceeded 20 m/sec at approximately 12:00 and from this point it is believed that the Master began to make a concerted effort to verify the condition of anchorage. Subsequently, the first anchor dragging began at approximately 12:58, and an attempt was made to control the position of the hull making full use of the engines and the VecTwin Rudder. Then at approximately 13:10, the Master, being under the illusion that anchor dragging had been arrested, set the joystick to the hover position.

- Wind speed exceeding 20m/sec. (Approximately 12:00)
- Hovering (13:10) for 70 minutes



Concentration for an adult human normally lasts for around 45 to 50 minutes. At best it is 90 minutes. Thus, it makes sense that one class for elementary and junior high schools is set at around 45 to 50 minutes and that one lecture at a university is set at 90 minutes.

There are waves every 15 minutes at a sustained period, and after that three more waves (45 minutes in total), then concentration gradually decreases.
Here, we understand that the Master's level of concentration nearly reached its limit, because 70 minutes had already elapsed especially from when the wind speed increased to the start of hovering.

= Psychology behind sense of achievement and tension reduction =

There is a story titled "A man who was famous as a tree climber" in Essays in Idleness also known as "The Harvest of Leisure" written by Yoshida Kenko (c.700 years ago). This is the story.

A man who was famous as a tree climber was guiding his servant in climbing a tall tree. This expert climber ordered the servant to cut the top branches. During this work when he seemed to be in great danger, the expert did not say anything. Only when he was coming down and had reached the height of the eaves did the expert call out, "Be careful! Watch your step coming down!"
Kenko asked the expert, "Why did you say that? From that height he could have jumped the rest of the way if he so chose."
"That's the point," said the expert. "As long as the man was up at a dizzy height and the branches were threatening to break, he himself was so afraid I said nothing. **Mistakes are always made when people get to the easy places.** "

Also when you get an *ippon* win in kendo, it is customary to part by stepping back attentively, not turning back and around carelessly. Moreover, it is customary in *Sadou* (Japanese art of tea ceremony), after serving tea to your guest, to keep the position of your hand as it is when returning to your original position of *seiza* (sitting in a kneeling position) without losing one's concentration to the end.
A famous tea master, Sen no Rikyū (1522 – 1591) exhorts his *Zanshin* (importance) in his song: *Naninitemo okitsukekaheru tebanarewa koishikihitoni wakarurutoshire* (When

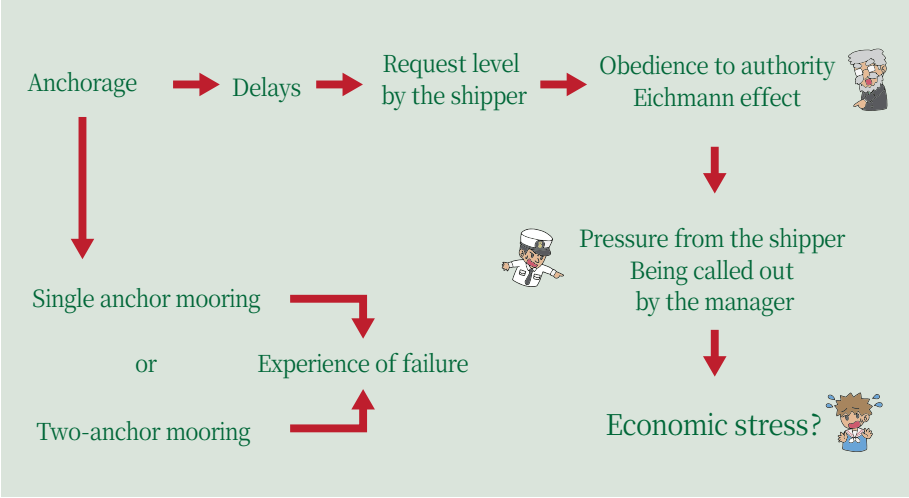
withdrawing hands from tea utensils, move them with *yoin* [lingering memory/aftertaste] as if parting from someone you love.)

The word zanshin is used in Japanese martial arts and traditional artistic skills. Literally interpreted to mean an afterglow/lingering memory which shows the state of being conscious, especially just after honing one's skills, one is still tense while releasing or relaxing. (From Wikipedia)

= Other factors =

- Presumably the next cargo loading/offloading which was due to take place at Sakai Senboku Port in Hanshin Harbour was influential.

As the above is briefly mentioned in the Japan Transport Safety Board Report, the background of which is summarized in the chart below.



Considering the above mentioned Hindsight Bias, the following comment "If I were you, I would have escaped to Harima-nada immediately" was made. It is true that a

suitable place to anchor was to be found near Shodoshima and Ieshima, at which the wind was blocked. Naturally, the Master would have had a similar thought. However, it is possible to imagine that the Master may have made his decision as a result of a mixture of normalcy bias and peer pressure, together with economical stress; perhaps the Master was thinking about schedule recovery following the passing of the typhoon.

4－5 Psychological explanation for Obedience to Authority (Eichmann effect)

Regarding Obedience to Authority, the lecturer will describe this from a psychological perspective as follows. (For details, P.76 of our Bulletin No.46)

The Eichmann effect was to find out to what extent a sincere person, known to be just, on average would obey orders to give a helpless victim fatal electric shocks.

A renowned university professor (authoritative person) assembled two groups of volunteers in their 20s-50s, one group playing the role of teacher (the one with the questions) and one group to play the role of a student (the one who answers questions). The purpose was to measure the impact of punishment on learning and memory. The students were then set a task of remembering simple words. The experiment was as follows: A student sat in an electric seat, and if he/she was unable to answer the teacher's question, the teacher would give him/her an electric shock.
When the teacher asked the question, "Red", and the student mistakenly answered "House" instead of the required answer "Box", the teacher would flick a switch that delivered 15 volts of electricity. Every time the respondent answered with the wrong answer the voltage was increased by another 15 volts.
The person who was supposed to be given an electric shock was an actor, and the chair was not connected to a source of electricity, so naturally there was no electricity running