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The impact of gadgets on the performance of professional duties

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Abstract

In this thesis, I want to reveal to the reader such a young problem of shipping as the effect of gadgets on attention and concentration. I consider the purpose of this study to increase attention to this problem, every sailor should understand that gadgets negatively affect the performance of duties. Given the specific of the topic, I used only one suitable method – experiment, using the simulator systems. I wrote the theoretical part based on various sources of information, mainly various articles, forming my own opinion and text. It talks about real incidents related to distraction of gadgets, also talks about such a common problem as addiction to gadgets, about how human attention works.

I hope that the results of my research will be useful for the maritime industry, as I was able to clearly show how incidents and gadgets are interconnected. I describe my experiment in sufficient detail, many screenshots from the control computer with information about the vessel and its position relative to the route help me in this.

The experiment was carried out at the Aboa Mare Academy, with the help of volunteers who agreed to participate in the experiment. I would like to express special gratitude to teacher Emilia Lindroos for help in organizing the experiment and training exercise.

Language: English Key words:

Table of contents

1 Introduction

I was inspired to create this work by a case. I was walking down the street to the bus stop and typing a message in the chat of my football team that I would most likely be late. The reason for the possible delay to the word was also the phone because I watched the video and did not get ready on time.

And here I am walking down the street looking at the phone and I don't notice at all how I'm moving straight towards the driving car. The area was pedestrian, and the speed limit was 20 km/h, so the car just stopped in front of me, and I saw the puzzled face of the driver. And only at that moment I realized that I look extremely stupid, and besides, it could be dangerous if the speed of the car was for example 10 km/h higher. The phone distracted my attention so much that I did not notice the dangerous situation, and if I walked looking ahead, this situation would not be possible.

It hasn't been ten years since Steve Jobs promised us that smartphones would ''change everything''. Today, when everyone has a device with Internet access in their pocket, we are constantly bombarded with notifications: SMS, email, social network message, sports program reminder. Human is naturally curious, and if there is a constant source of information, no matter what the content, it can really take up most of his attention.

Since I am studying for such a specialty as a navigator, I am well aware that attention is one of the main working tools of any navigator. Anything can happen during the watch, and we must always be aware of what is happening, understand what happened 5 minutes ago, and calculate what will happen, for example, in half an hour. When I started researching on this topic, I never imagined that mobile phone distraction was causing companies to lose more than $60 million. And I could not imagine that the fault would be not a young navigator with little experience, but a fully qualified captain, or a pilot. Even the most experienced and qualified professionals also lose attention and control over the situation by being distracted by a smartphone or other device. In addition, distraction on the phone, for example, during cargo operations, when you need to monitor what is happening around you,

when multi-ton containers and trailers are in motion right next to you, can lead to death or severe injury.

Therefore, I decided to explore this topic more deeply, in my opinion it is important, in the age of technology, no one can be without a gadget, and falls into the risk zone. There have already been many studies of the influence of a mobile phone on human attention among students, drivers, office workers, and now I would like to do it in the maritime field. Of course, the solution to this problem is obvious, to prohibit the use of personal devices while on duty. And many companies write it in their crew manuals. However, this is quite difficult, and sometimes impossible to control, this is a type of situation where a person himself, without any instructions or orders, must realize what he should not do. And with this study, I would like to show, and once again remind you of the dangers of losing concentration in the workplace.

2 Examples of incidents related to loss of concentration due to the gadgets.

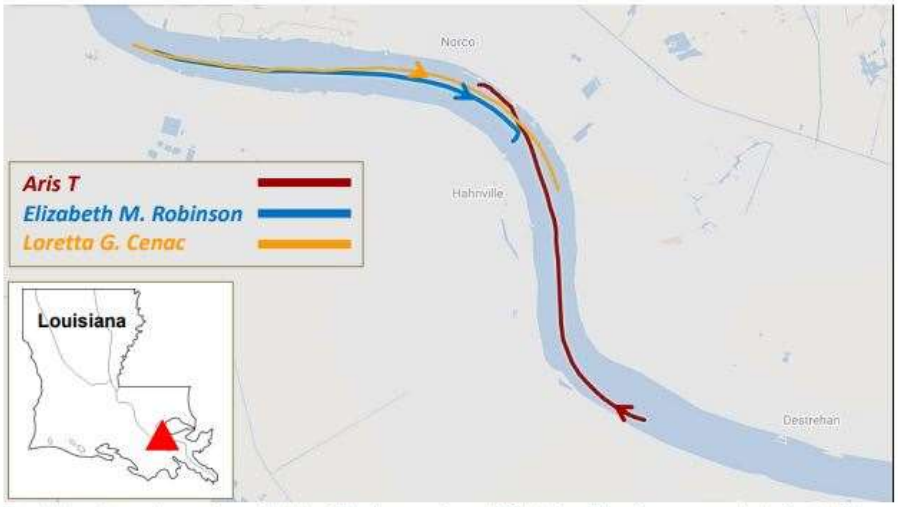
To find a basis for my research, I turned to archived incident reports related to my field of research. In my opinion, these cases are suitable for a visual demonstration of the existing problem.

2.1 Collision of Bulk Carrier Aris T with tank barge WTC 3019, towing vessel Pedernales, and shoreside structures

On January 31, 2016, at 19:53 local time, bulk carrier Aris T collided with tank barge WTC 3019, towing vessel Pedernales, and two facility structures, all of which were located on the left descending bank of the Mississippi River between mile marker (mm) 125.2 and mm 126.0 at Norco, Louisiana.

Total damage cost to more than $60 million, two dock workers reported injuries.

Figure 1 "Aris T postaccident image by US coastguard"



Tracklines based on automatic identification system (AIS) data of the three vessels in the half hour leading up to the accident. (Background by Google Maps)

Figure 2

The National Transportation Safety Board determines that the probable cause of the collision was the failure of the pilot on the Aris T to take early and effective action to mitigate the risk presented by the developing upriver traffic situation, and the

distraction of the captain on the Loretta G. Cenac from safety-critical navigational functions as a result of his cell phone use.

The captain on the Loretta G. Cenac was likely distracted while using his cell phone and therefore inattentive to his navigational duties. The captain acknowledged that leading up to the accident he was on the phone with his girlfriend, including the time during his first VHF radio conversation with the pilot on the Aris T to discuss meeting arrangements. The captain on the

Loretta G. Cenac spent a significant amount of time on nonoperational communication when he should have been focused on safely navigating the vessel. The company policy prohibiting the use of cell phones while on watch, which was to be enforced by the captain himself, was clearly not successfully implemented.

Had the captain on the Loretta G. Cenac been focused on his navigational duties instead of on the communication with his girlfriend at 19:47, the images on the vessel's radar and electronic chart would likely have raised his awareness of the dangerous traffic situation that was developing.

The captain then could have aborted his attempted overtaking of the Elizabeth M. Robinson earlier than he did, or possibly recommended to the pilot on the Aris T that he slow the bulk carrier's upriver speed to allow sufficient time for the overtaking maneuver to be safely completed.

We can see that time between phone using and collision is 6 minutes.

Captain used phone in situation where he had to focus only on radar and VHF calls with another vessel.

2.2 Grounding of the Italian registered chemical tanker Attilio Levoli

At approximately 1632 (UTC +1) on 3 June 2004, the Italian registered, double hulled chemical tanker Attilio Levoli run aground on Lymington Banks in the west Solent. The vessel suffered bottom plate indentation forward but no hull penetration.

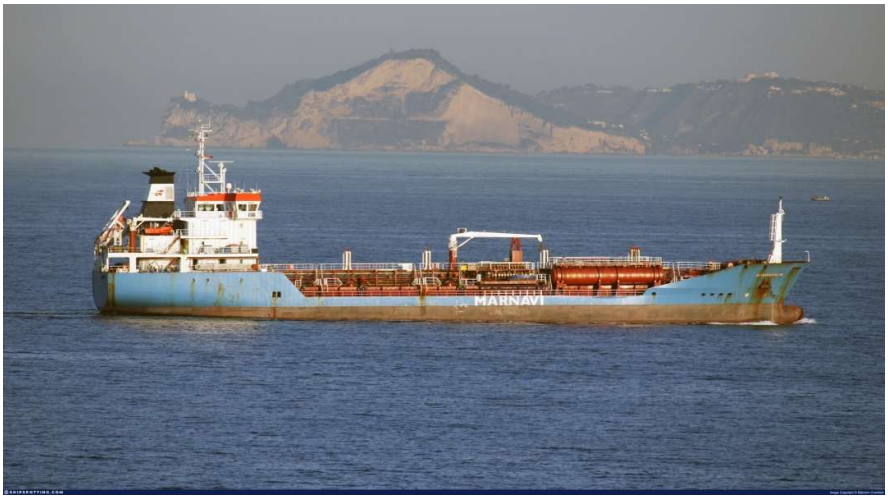


Figure 3 "Attilio Levoli"

Figure 4 "Southampton VTS area"

It was a clear day, with little recreational craft traffic and no other commercial traffic in the west Solent. Neither the second officer nor the cadet were sure of who was responsible for plotting positions on the chart, although both did some rudimentary checking off buoys passed. The master was not paying attention to the navigation of the vessel and was distracted by using the ship's mobile telephone.

Attilio Levoli run aground on Lymington Banks at about 1632, at a speed of about 11 knots. At this point she was approximately 0.5 mile north of her intended track.

Poor bridge team management on the vessel resulted in a lack of accurate vessel positional awareness and an inappropriate division of tasks. The use of the mobile telephone distracted the master from his primary responsibilities.

Evidence from mobile telephone records shows that calls were made from Attilio Levoli's mobile telephone in the minutes leading up to the accident as follows:

Time Duration	Minutes: seconds
1600	11:33
1615	1:10
1618	3:59
1631	2:37
1636	6:21

We can see that phone was used all 30 minutes before accident and captain was out of situation.

2.3 The third officer of the Isle of Man-registered freight ferry Seatruck Progress was killed when he was hit by a semi-trailer.

Figure 5 "Seatruck Progress"

On 15 May 2019, a third officer onboard the Isle of Man registered ro-ro freight ferry, Seatruck Progress, was fatally injured after being struck by a semi-trailer that was being pushed down the vessel's stern ramp. The driver of the tractor unit pushing the trailer stopped immediately, but the third officer was trapped between the trailer's rear wheels and was declared life extinct by attending paramedics. The tractor unit driver was found to have cannabis in his system, but this was unlikely to have impaired his driving ability or affected his judgment.

The third officer was standing on the stern ramp and was talking on his mobile telephone when he was struck. He was facing down the ramp and was unaware of the trailer approaching from behind. The tractor unit's driver was not expecting any pedestrians to be on the stern ramp and could not see the third officer due to the trailer blocking his view ahead.

Several studies have been conducted to determine the extent to which mobile phone usage leads to distraction, with most focusing on the distraction of drivers in moving vehicles. The findings of these studies suggest that a driver using a mobile phone concentrates on the demands connected with mobile phone use to the detriment of their wider situational awareness. As a result, a driver is up to four times more likely to have an accident while using a mobile phone than when not.

The findings of studies examining mobile phone use by pedestrians walking on a street suggest that 14% of pedestrians using a phone will have collisions with objects or walk across roads without looking beforehand.

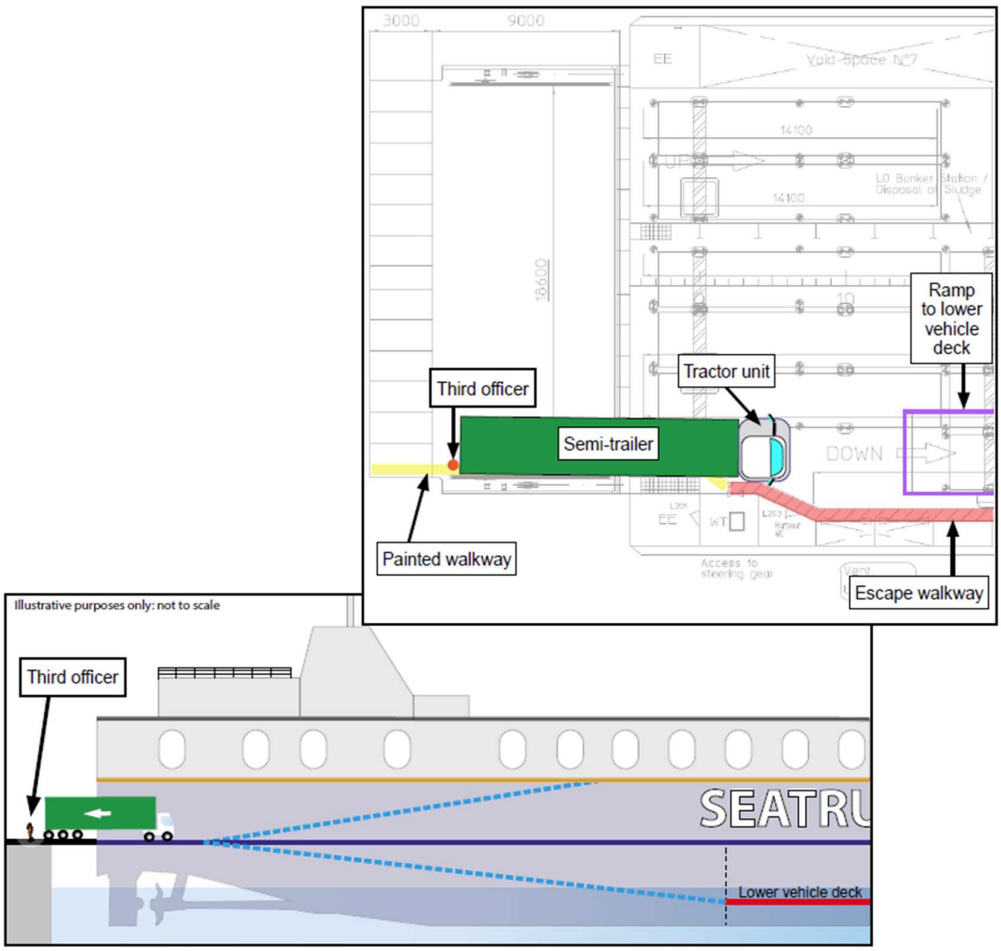


Figure 6 "Visual plan of the incident"

We can see that 3d officer was in dangerous zone, and he was completely focused on the mobile phone, during the cargo operations.

2.4 Grounding of the containership Ever Forward

On March 13, 2022, at approximately 1812 Eastern Standard Time (EST), the Hong Kong flagged containership EVER FORWARD departed Seagirt Marine Terminal in Baltimore, Maryland on route to Norfolk, Virginia with a licensed Maryland State Pilot, hereinafter referred to as “Pilot 1,” in direction and control of the vessel. The vessel’s departure was slightly delayed due to a line handling issue at the facility.

Pilot 1 was on the bridge with the Master and the bridge team until approximately 1930, when the Master departed the bridge to get dinner. At approximately 1950, the

bridge team completed a scheduled watch relief, and a new Third Officer and Deck Cadet reported to the bridge. At this time, the bridge team was comprised of Pilot 1, the Third Officer, Deck Cadet, and an Able Seaman who was at the helm. At approximately 2017, the vessel passed its charted waypoint, marking a turn to approximately 180 degrees True that needed to be executed in accordance with the voyage plan. No order was given to turn the vessel and the helmsman maintained the previously ordered course of 161 degrees true. At 2018, Pilot 1 recognized the vessel was past its turn and ordered 15 degrees rudder to starboard. The vessel grounded outside the Craighill Channel, east of Lighted Buoy 16.

Figure 7 "Refloating operation with tugs"

For approximately half of the two-hour transit, the pilot on board the container ship placed and received numerous calls, text messages and draft emails on a personal mobile phone right up to the grounding.

The pilot admittedly relied solely on the Portable Pilot Unit for navigation and was watching playback of a previous transit at the time of the incident.

US Coast Guard said “the pilot was drafting an email on a personal phone in the minutes leading up to the planned turn south, when the vessel sailed through its waypoint and grounded.

The pilot showed blatant incompetence using his personal mobile phone throughout the ship's grounding process, missing the turn that caused the incident.

3 What is attention? What is attention like?

The term attention is commonly understood as the focus of human consciousness (or mental focus) on specific objects and phenomena that have situational or stable significance for a person. Also, this concept means the concentration of consciousness, which implies a high degree of sensory, motor, or intellectual activity.

3.1 Involuntary attention

Involuntary attention (also called emotional or passive) is the concentration of consciousness on some object, due to its characteristics. In this case, there is a dependence of attention on the object that attracts it, and the person himself has a lack of efforts aimed at concentration. And speaking of the emotional component, they distinguish the connection between the object of attention and emotions, needs and interests. There are also no volitional efforts aimed at concentration.

Any irritant with different force of influence can attract attention. When the stimulus is new, it also becomes the cause of involuntary attention. A huge role in the appearance of involuntary attention is played by human feelings - moral, aesthetic, and intellectual. If, for example, an object causes delight or surprise, attention is riveted to it for a long time. And with interest, as with a direct interest in something and as with a selective attitude to reality, feelings are connected. For this reason, interest is recognized as the most important cause of prolonged involuntary attention.

3.2 Arbitrary (voluntary) attention

Arbitrary attention (it is called volitional or active) is considered to be a consciously controlled concentration on a phenomenon or object. Here a person focuses not on what is of interest to him, and not on what gives him pleasure, but on what he needs to do. The presented kind of attention is directly connected with the will.

When a person concentrates on something, he makes an effort of will that maintains attention throughout the process. Effort of will can be perceived as a mobilization of resources or the tension necessary to solve a task.

Voluntary attention arises when a person has a goal to perform some work that requires concentration. And the reason for the origin of this type of attention in general is labor. The most important condition that supports voluntary attention can be called a mental state. For example, if a person is tired, it is more difficult for him to concentrate. Also, voluntary attention is weakened by emotional arousal caused by extraneous stimuli.

3.3 **Features of attention**

Features of attention are expressed in its properties: volume, concentration, distribution, stability, fluctuations, and switch ability.

Few words about each of them:

- Volume - expressed in the number of simultaneously perceived objects. It depends on genetic factors, the potential of short-term memory, experience, professional skills, goals and nuances of perceived objects.
- Concentration - the level of concentration of the psyche on the object. In the process of concentration, a temporary focus of mental activity is created. The smaller the volume of perceived objects, the higher the concentration.
- Distributability - the ability of a person to simultaneously perform a series of actions or observe several objects or phenomena. The distribution of attention is because the brain can optimally distribute excitability across areas of the cortex. This provides the ability to manage multiple processes simultaneously.
- Sustainability - a general focus. It depends on the type of nervous system, motivation, and temperament. The most important condition for sustainability is the variety of impressions received. Its opposite property is distractibility.
- Fluctuations - phenomena that are observed even when a person is focused and tense. They are explained by the process of constant change of excitation and inhibition in the cerebral cortex. If fluctuations occur for a long time, they can cause involuntary distraction.

- Switch ability - the restructuring of attention from one object or phenomenon to another. Switching is voluntary and involuntary. The first occurs when the nature of the activity changes or new tasks are set, and the person makes volitional efforts. The second occurs without the participation of the will, but under the influence of external factors.

American scientists from the University of Texas at Austin conducted a study in which it turned out that the mere presence of a smartphone next to a person reduces the mental abilities of the owner. The fact is that a smartphone constantly distracts a person, this is true even if the phone is nearby without giving any signals.

To test the possible influence of the phone on the mental abilities of a person, scientists divided the volunteers into several groups. Representatives of all groups were asked to sit down at the computer and perform a series of tests that help determine the mental abilities of a person. Basically, the ability to keep certain data in mind was tested by doing (again in the mind) calculations.

Before the tests began, the participants were asked to position the phone in a certain way. Someone was told to put the phone face down on the table, someone to hide the device in a bag or give it to an observer from the next room. Regardless of the location of the phone, all devices were set to silent mode.

As it turned out, those participants whose phones were located in another room performed the tests best of all, and the advantage was significant, above the statistical error. The results of participants from the group of people whose phones were maximally removed turned out to be higher than the results of those volunteers whose devices were placed in a bag or just a pants pocket.

After analyzing the results of this experiment, the scientists came to the conclusion mentioned above: part of a person's mental resources are drawn to a nearby apparatus. Even if the owner of the device, as it seems to him, does not pay any attention to the device, he subconsciously waits for a call or signal. Accordingly, the level of mental abilities falls.

“We noticed a linear relationship, which suggests that the more visible to the user the phone, the lower the level of cognitive abilities of this person,” says the head of the

research team. “Your consciousness may be free from thoughts about the phone, but the subconscious process, entered into the waiting mode for a signal from the phone, uses the resources of the brain, depleting it.”

Well, if we talk about how much the phone distracts the attention of a person while working with the device, then here you can find many amazing examples. During a conversation with a virtual interlocutor, walking down the street, a person notices almost nothing. Once they conducted an experiment when a brightly dressed clown on a unicycle passed in front of people busy talking on a cell phone. Of course, he did not pass at arm's length, but almost nearby. As a result, it turned out that most people talking on the phone did not notice this clown. Then these same people were very surprised that they did not see such a prominent character.

4 What is Nomophobia?

Nomophobia is a person's fear of being left without a mobile phone. A person suffering from nomophobia cannot be without a phone for a single day. If the phone is accidentally forgotten at home, the person begins to get nervous, and it seems to him that the whole day has passed in vain. A person suffering from nomophobia does not let go of the phone, constantly collects SMS, goes to e-mail, checks for new letters, and in his free time communicates with friends about nothing. Because each time the recipient almost does not let go of the phone or even more to talk to another person, it is easier for them to talk on the phone than to meet and talk on the street.

The main reason for this disease is the fear of a person to remain helpless, to remain isolated from the whole society. Many nomophobes claim to send a hundred messages per day, although this takes a lot of time.

Nomophobia is a young disease, and it arose when mobile phones were already available to everyone. An experiment was conducted at a British university, 12 countries participated in it. The essence of the experiment is: will students be able not to use the phone for a day? Not everyone survived this experiment. The students who were left without phones felt broken. They felt the way people who smoke feel when they want to quit but fail to do so.

Considering the specifics of the work of seafarers, I can say that in some cases, due to circumstances, such as, for example, a prolonged lack of communication and the Internet, nomophobia can be very acute.

For example, when a ship has been on the high seas far from the coast for a long time, everyone wants to communicate with family and friends, read the news or watch their favorite movie.

Also, remembering high technologies, we know that, for example, sailors working in the Baltic Sea almost always have access to the Internet, which, in my opinion, has significant advantages in the form of the opportunity to communicate with relatives etc., but also has significant disadvantages and I would like to talk more about this:

- A person spends all his free time using the Internet and gadgets. This is a rather sad fact, but it is very rare to meet people in the lounge or in the gym, basically everyone spends time in the cabin and practically does not communicate in their free time, except for eating or some kind of grill party.
- A person becomes dependent on the Internet, on the constant possibility of obtaining information, and he wants to use it during working hours also. If there is no Internet access, a person does not know what to do.
- Decreased vision. It is very important, especially for a navigator to have good eyesight, but the constant use of gadgets contributes to a drop in vision.
- Sleep problems. Seafarers may use internet access until late at night for the above reasons, and this leads to a lack of sleep, and consequently a decrease in efficiency in the workplace.

As we can see, there are more minuses than pluses, moreover, these minuses lead to a possible violation of the normal performance of duties.

A person gets used to the fact that he can constantly use the phone, and during the watch, when he is required to focus on the radar, his attention is directed not at all where it is required, and this leads to sad consequences.

5 Practical experiment

My research could not do without a practical experiment, the results of which clearly showed the harm from using a mobile phone while operating a ship.

5.1 Conditions for participants

When developing the experiment, I decided to act according to the same scheme used by American scientists from the University of Texas at Austin, so, I made three different conditions for the participants in the experiment, so that I could visually demonstrate the difference between the results.

The first participant left his phone outside the simulator and had no access to it during the experiment, and therefore 100 percent of his attention was directed to the control of the vessel.

The task of the second participant was to use about 50 percent of their attention on the phone (messenger, news viewing, etc.). Thus, only 50 percent of his attention was directed to the navigation of the ship.

The third participant was in the most difficult conditions in terms of concentration. He had to concentrate as much as possible on his mobile phone, namely the video, which required a lot of concentration to watch. Rather, a secondary task for him was at the same time managing the ship. Of course, the control of the ship is always a paramount task, but in my experiment, I strive to show how devastating a lack of concentration can be.

I will add that all participants had approximately equal qualifications at the time of the experiment.

5.2 Route

The task for all participants was the same, they started at the same time on different simulators. Navigation systems were “Consilium” on all three simulators, i.e., the participants were also in the same conditions regarding navigation equipment.

Now let's move on to the navigation task. I have been thinking for a long time about what exactly I should focus on when choosing navigation conditions for participants. The two main options were:

- High traffic situation in open sea. During a navigational watch in the Baltic Sea area, this happens quite rarely, mainly when entering the port. Here the navigator requires a high concentration of attention, you need to constantly control the CPA, TCPA and speed of all targets. As a rule, in such situations, the

vessel goes on autopilot, manual control is not involved. But in this situation, there is a significant difference from the second option, in the situation described above, the occurrence of a risk of collision also depends on the other vessel with which you have crossing courses. In addition, navigators have more than enough space and time to perform a maneuver that removes the risk of collision.

- Narrow channel in an archipelago where there are also other ships coming towards you, or on the same route. This option, in my opinion, is more complicated than the previous one, since here we are dealing with the risk of running the ship aground. In addition, we need to control the situation with other vessels, and we have little space and time to make the right decision regarding maneuvering. Also, while navigating in such areas, we cannot rely on the autopilot, as we must 100 percent control the movement of the vessel, speed, turns and rotation. In my opinion, this situation requires more concentration, and therefore is better suited for my experiment.

After I decided on the choice of situation, it was necessary to choose a place. I decided that it would be the Baltic Sea, since there is a large choice of route among the archipelagos, and besides, there were a lot of real routes on the simulators.

Since I had a wide choice of routes, I wanted to choose one where incidents had already happened. The Finnish-flagged passenger ferry FINNFELLOW grounded on her way from Kappelskär to Naantali at 02:32 on 2 April 2000 on the north shore of Föglö in the Aland archipelago. There were 81 people on board, 58 of whom were passengers. The vessel run aground at a speed of about 14 knots as a result of a gyrocompass malfunction.

I was interested in this case, because, after studying the route, I saw that there is exactly what I am looking for, in addition, I had the opportunity to add my own edits, and the experiment should turn out to be exciting.

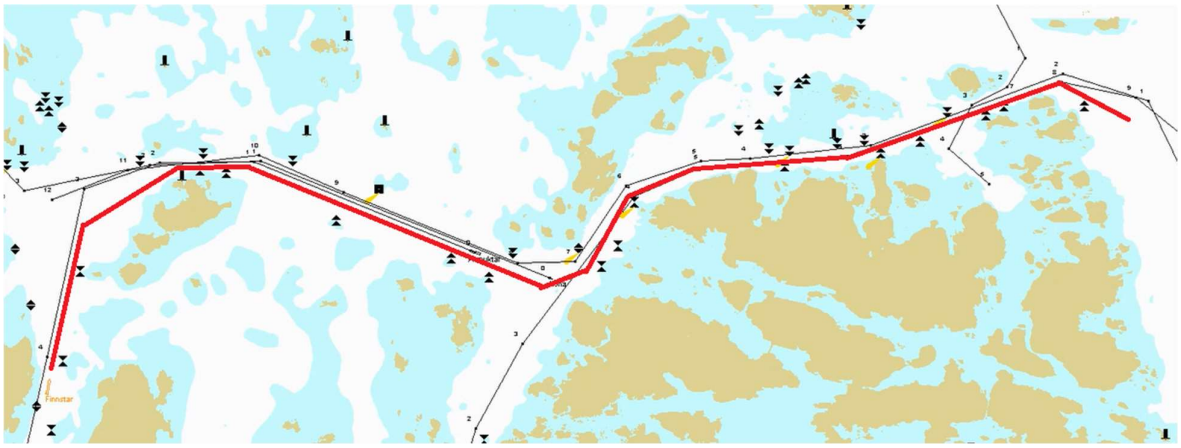


Figure 8 "Route for the participants"

On this route, there is good opportunity to combine a turn in a narrow space and meet other ships. As we can see on a picture, vessel start route from SW and course is 010^0, starting position is NE from island Bjerke.

After start, navigator should care of a safe and timely right turn, the route line is going between Stockgrund island from the north and Gröna holmen from the south. The fairway is quite narrow, and it is necessary to pass on its right side, in case of oncoming ships. After turning, a long straight line, on which the right side also should be held. This is followed by a left turn, vessel should proceed between Aspören and Skarpskaer islands from the west and Ramsö käringen island from the east, where is important to keep in mind the cardinal marks from the starboard side. Leaving the left turn, navigator must immediately prepare for the right turn, which starts very soon. This is followed by a relatively straight but narrow section, at the exit from which the route ends.

The difficult level of this route is not so high but requires sufficient attention and planning.

5.3 Vessels involved in the experiment.

For the experiment, I chose a large enough but at the same time maneuverable vessel type Ro-Ro “Finnstar”. Vessels of this class regularly pass the archipelago and perfectly suitable for my research.

To make task more difficult, AIS on all target vessels is off, because it quite easy to see other vessels on ECDIS, navigator must keep sharp lookout and look at the radar.

The first target vessel which navigator meets on a route is a container vessel Al Mukhtar (speed 11 knots), and it is most difficult part of the route, because vessels are meets in a first narrow turn, situation is quite dangerous and there is a risk of collision, needs to strictly monitor the situation.

Figure 9 "Al Mukhtar"

Second target vessel is a coast guard vessel Aloha (speed 7,7 knots), that we meet after first turn.

Figure 10 "Aloha"

The third target vessel is Viking Glory (speed13 knots), here is also quite small space to maneuvering, and navigator should calculate turn trajectory and make turn very accurate.

Figure 11 "Viking Glory"

I choose all these ships not randomly, my plan is made in conditions as close as possible to the real situation, with some complications aimed at ensuring that the navigator is required to increase attention to the situation.

The time of an exercise is about 3 AM, so it is quite bad visibility situation, considering that AIS turned off on all target vessels, it is possible to determine target vessels only by a radar, or visually, by seeing the navigation lights.

I did this in order to show how the phone using at nighttime on a bridge affects the quality of vision. That is, if a person looks at the phone screen for 5 minutes, then it takes about 40 seconds to see the situation outside, so that his vision adapts to the darkness.

Now let s move on to the experiment process. The participants were familiarized with the task immediately before the start of experiment and had the same time to prepare and learn the route plan.

5.4 First participant

First participant was on the bridge “Delta”. His phone was in control room, so, he had 100% attention on a navigation.

Start with the course 010^0 and speed 12 knots from position NE from island Bjerke. (Figure 12)

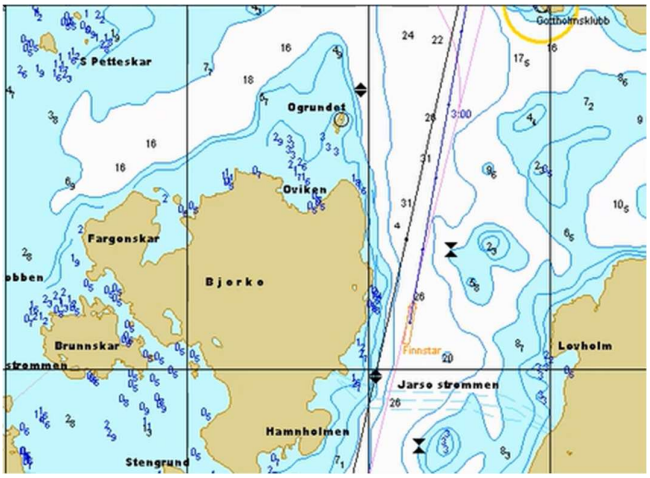


Figure 12 "Starting position."

Competently assessing the situation, the captain of “Delta” timely started turning to starboard. Speed 11 knots. (Figure 13)

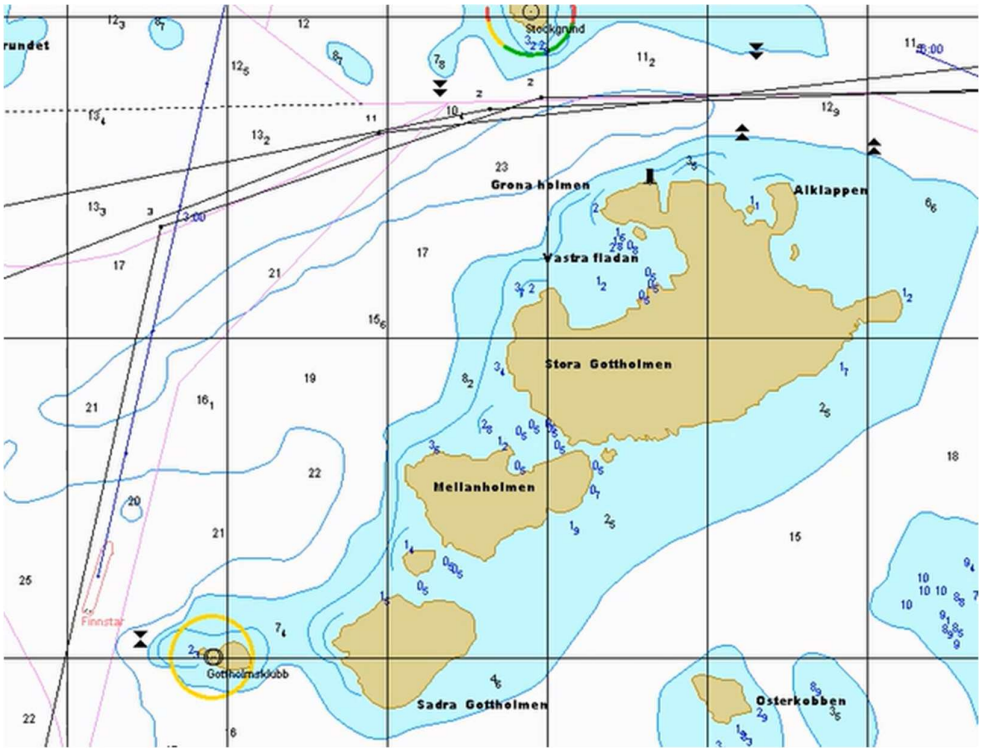


Figure 13

The new course is 053^0, speed 11 knots. As we can see, in general, the turn takes place gradually, with several course changes. Navigator closely monitors the situation and makes no mistakes. Correct turn gives a possibility to be on a starboard side of the fairway. (Figure 14)

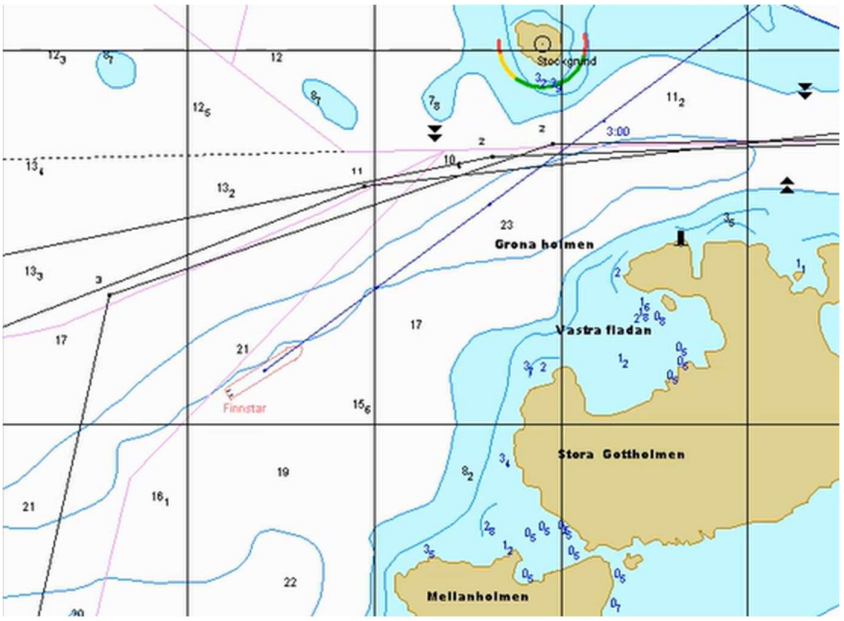


Figure 14

Course 066^0, speed 11,5 knots. The vessel is going along the starboard side of the fairway, as it should be in such situations. (Figure 15)

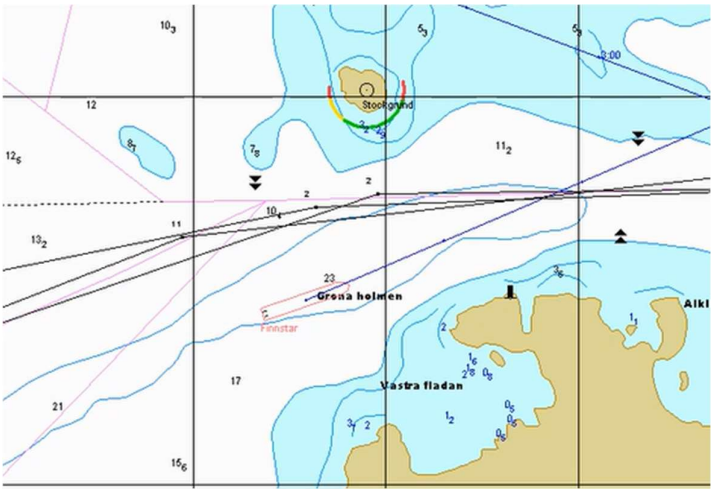


Figure 15

At the course 076^0 we can see significant closing with Al Muktar in a narrow turn, the distance is 5 cables. (Figure 16)

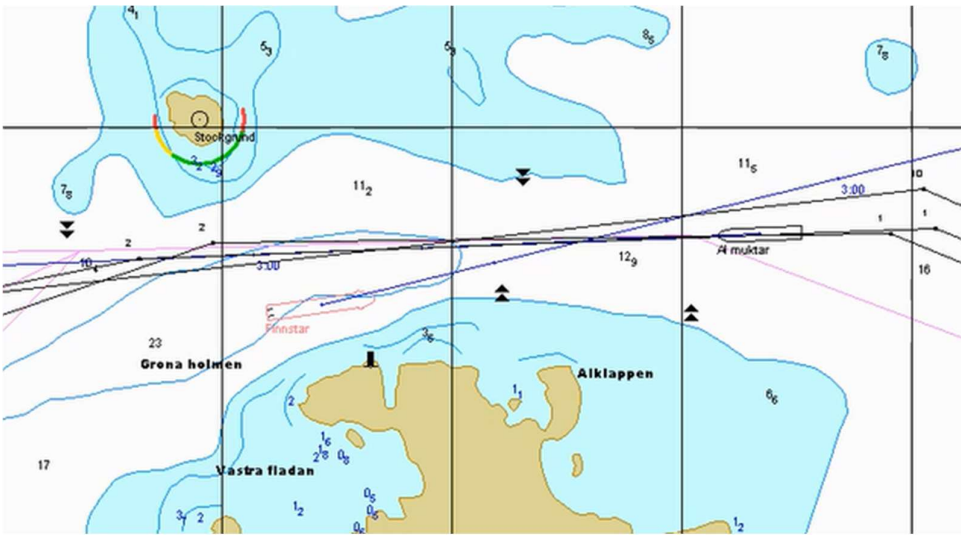


Figure 16

So, ships pass each other at a distance of a 0.5 cable, as can we see, Al Mukhtar occupies most of the fairway, and Finnstar has to go in the narrow space between the mark and another vessel. Navigator with maximum concentration does it perfectly. Speed 12 knots. (Figure 17)

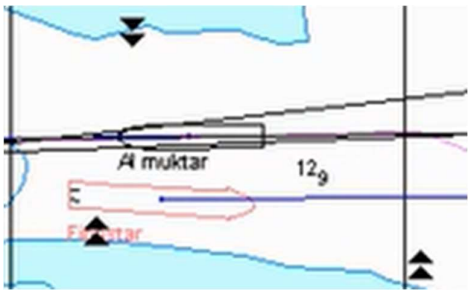


Figure 17

After this turn, Finnstar meets the coast guard vessel, and CPA is a bit less than 1 cable. Speed is 12 knots. (Figure 18)

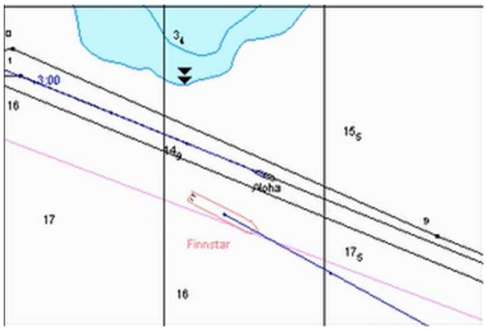


Figure 18

Finnstar is approaching the second turn with a heading of 110^0 and a speed of 12 knots. (Figure 19)

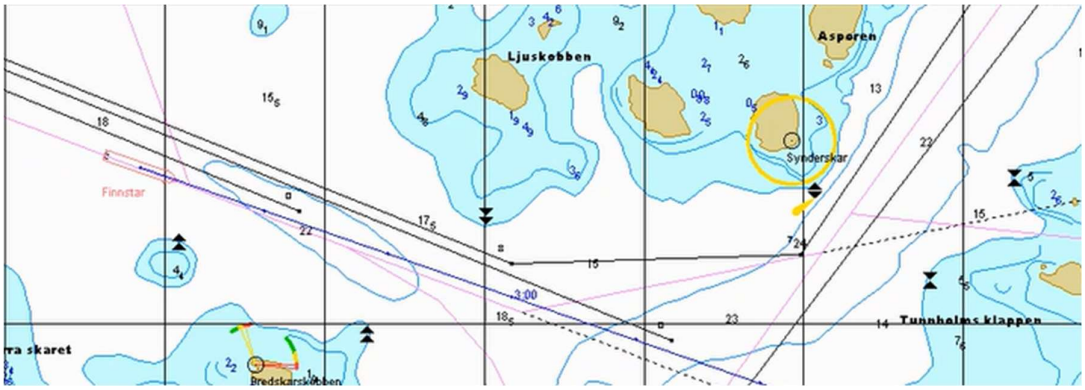


Figure 19

Finnstar clearly enters the turn, there are no oncoming vessels, so the navigator can use whole fairway for a calm turn. (Figure 20)

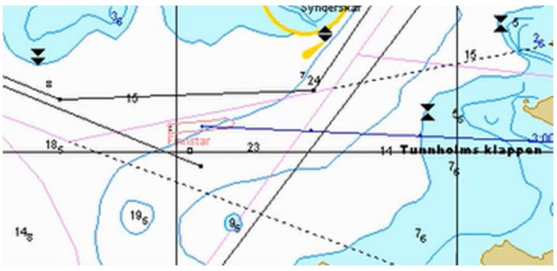


Figure 20

At the end of the turn, the navigator makes a mistake, seeing an oncoming vessel, he is finishing the turn too early, due to which he passes too close to the cardinal mark, and then is forced to enter the optimal course for the next turn (Figures 21, 22)

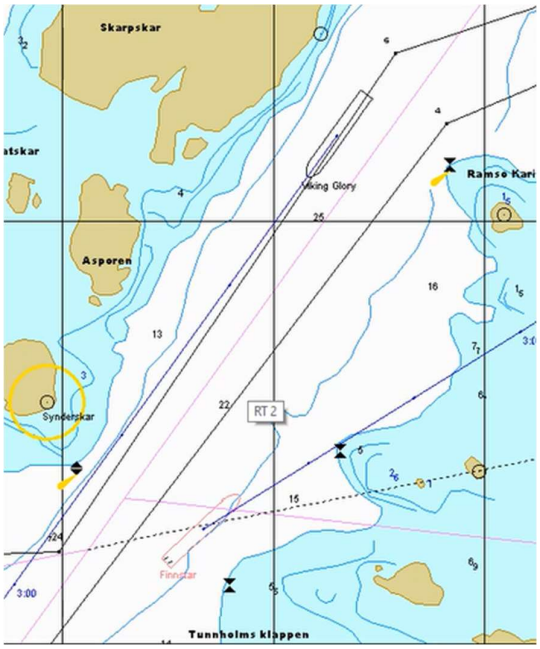


Figure 21

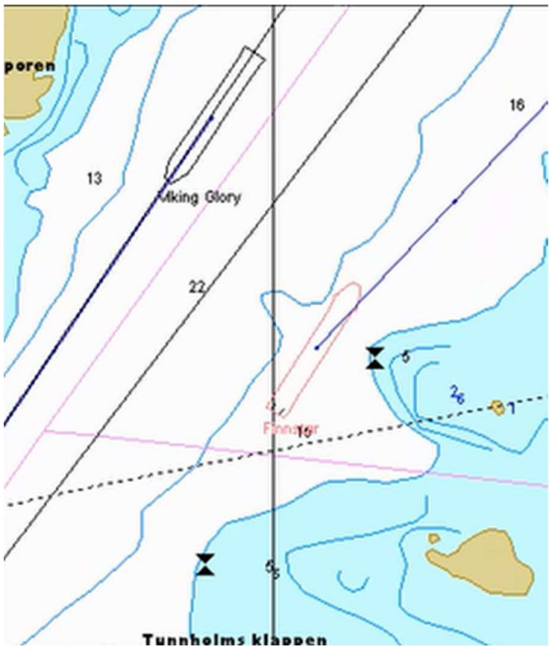


Figure 22

Due to an error, the vessel is in a bad position for manoeuvring, Finnstar has straight course to the mark. (Figure 23)

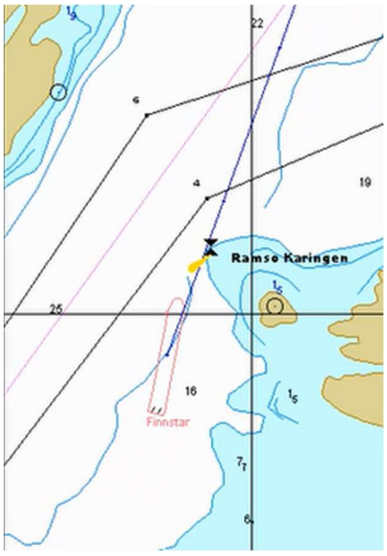


Figure 23

As we can see, the situation with the early end of the turn led to the fact that the Finnstar went to the left side of the fairway, if there was another vessel there, the collision would have been unavoidable. (Figure 24)

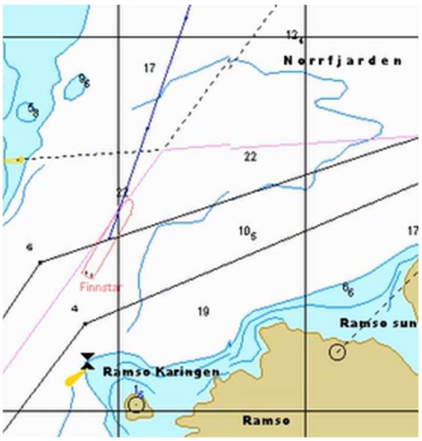


Figure 24

After that situation, after returning on a route, nothing interesting happens from the point of view of my research.

5.4.1 Conclusions from the results of the first participant

Due to the maximum concentration on the route, everything went well, until the moment of a mistake when finishing the turn. There are no emergency situations or stops during the navigation. Number of mistakes -1.

5.5 Second participant

Second participant was on the bridge “Gulf”. His task was to use about 50 percent of his attention for the mobile phone.

He started in same position, speed and course as a first participant. He had to correctly assess the upcoming turn and start it in advance. Here we can see, that unlike the first participant who started the turn immediately after passing the mark, second Finnstar captain is still following the same direction, even changing it a little by 5 degrees to port side, so course is 005^0, and speed is 12 knots. (Figure 25)

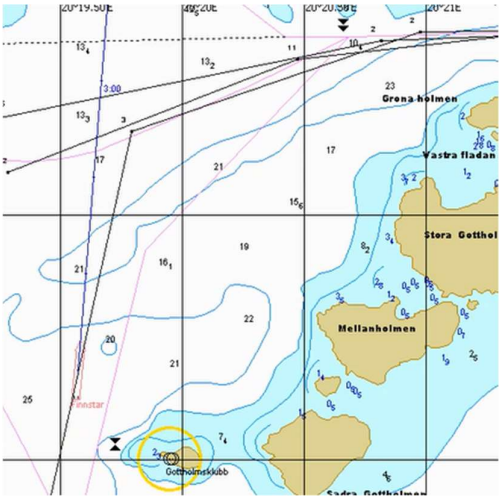


Figure 25

Turn starts quite late, and rotation is only 14 degrees per minute, which is very low in the current situation. (Figure 26)

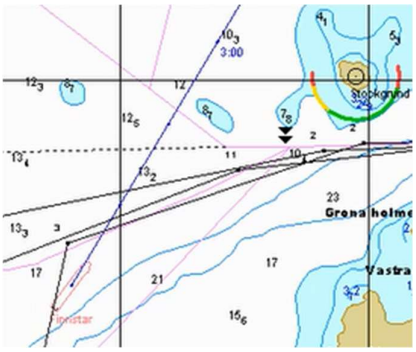


Figure 26

Everything goes to the risk of running aground, and the speed is reducing to 7.5 knots, while the course is only 48^0, but should already be about 90^o based on the current position and situation. Rotation is also bad, only 9 degrees per minute. By this time, we already can clearly see how much the phone distracts a navigator, that already at the first turn there is a risk of running aground. (Figure 27)

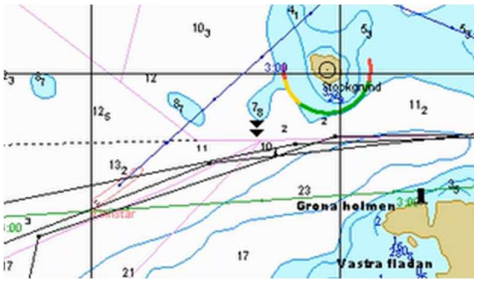


Figure 27

Further, the situation is almost completely out of control, and Finnstar is forced to stop to avoid grounding. (Figure 28)

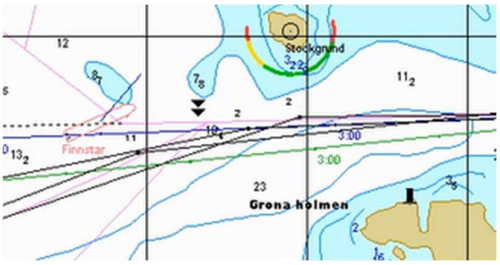


Figure 28

Finnstar makes a reverse and now has to wait until Al Mukhtar passing the turn. (Figure 29)

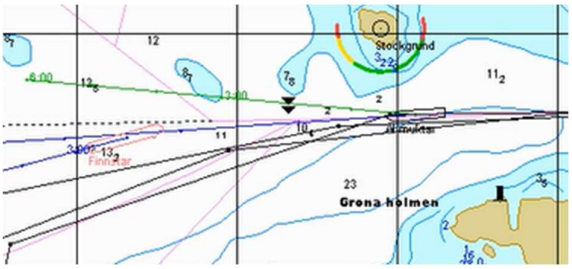


Figure 29

Only now Finnstar starts to go back on the route. (Figure 30)

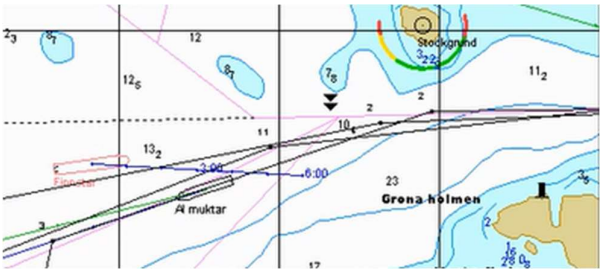


Figure 30

Having gained a speed of 12 knots, Finnstar passes the narrow fairway at the same time with a coast guard vessel towards, with a CPA of a 0.5 cable. (Figure 31)

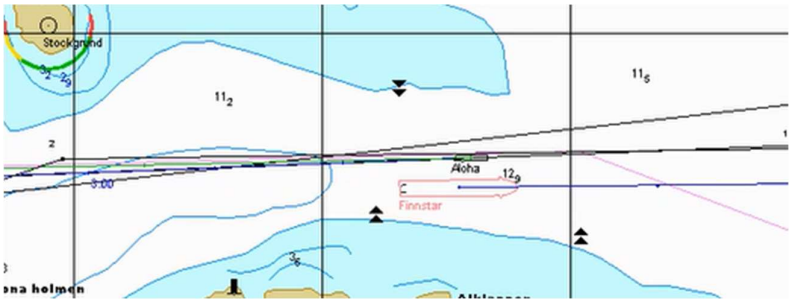


Figure 31

Before entering the second turn, Finnstar significantly reduce the speed to 5 knots, so Viking Glory passes the turn earlier. According to the participant, he made such an

unnecessary speed reduction because he was heavily distracted by the phone, and he was afraid the repeating of a risk of grounding situation. (Figure 32)

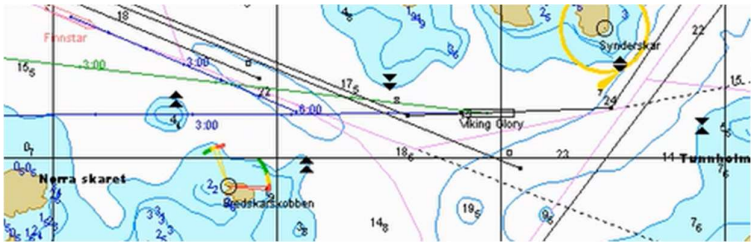


Figure 32

After the fairway has cleared, the speed increases to 8 knots, and Finnstar passes the second turn by the centre of the fairway. (Figure 33)

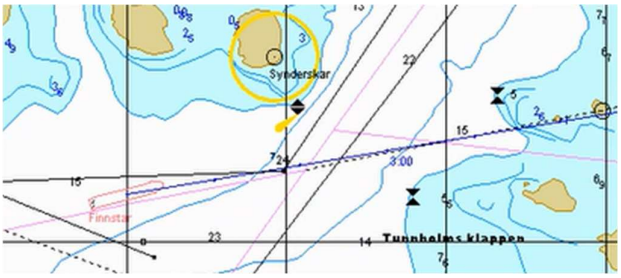


Figure 33

Since the second participant met the Viking Glory in the wrong place, according to my idea, I decided to simulate the situation of the meeting between the second and third turns, as it was for the first participant. The second participant done this task quite well, since he had the opportunity to freely make the second turn and prepare for the third one. CPA was more than 1 cable. (Figure 34)

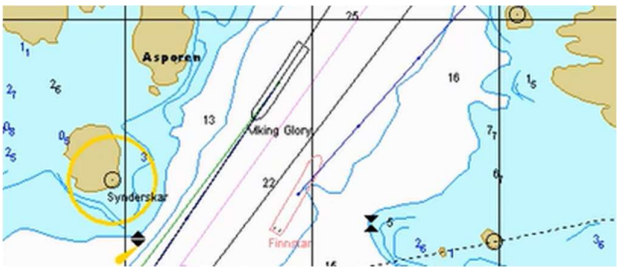


Figure 34

When performing the third turn, the same mistake is made as that of the first participant, the untimely start of the turn and, as a result, exit to the left side of the fairway. (Figure 35)

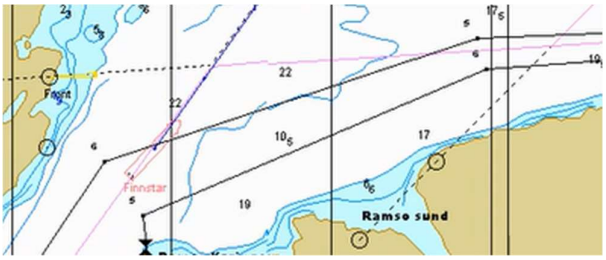


Figure 35

Then everything goes without complications, just like the first participant.

5.5.1 Conclusions from the results of the second participant

The situation almost immediately got out of control, as the navigator, distracted by the phone, could not correctly assess the situation, as a result of which the vessel almost grounded. I also want to highlight the unnecessary reduction of speed before the second turn. Also, there was a mistake during the entering the third turn. Number of mistakes-3.

5.6 Third participant

Third participant was on the bridge “Alfa”. His task was a use phone for a 100 percent attention, and same time navigating a vessel, we decided that interesting video is a good concentration affecting factor. Given the complexity of the route, the chance of a critical mistake was very high.

So, starting position is same as other participants, course 010°, speed 12 knots.

Third Finnstar captain started the experiment well and turning started in correct time. During the passage of mark, the course was already 016°, and speed is 18 knots. (Figure 36)

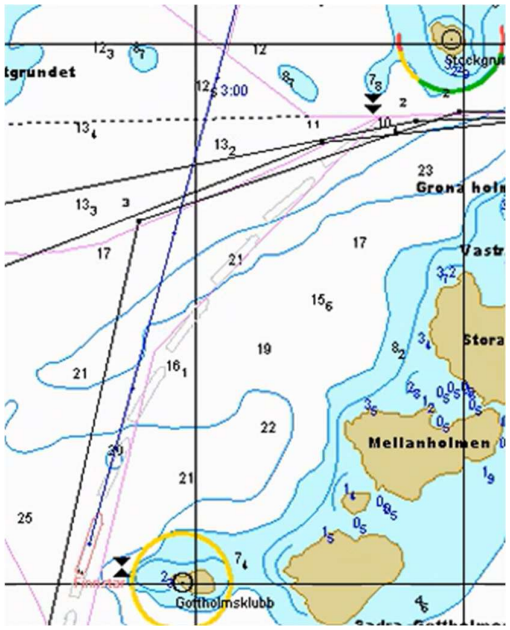


Figure 36

Navigator passes the turn correctly, trajectory is good, and speed is 19 knots. (Figure 37)

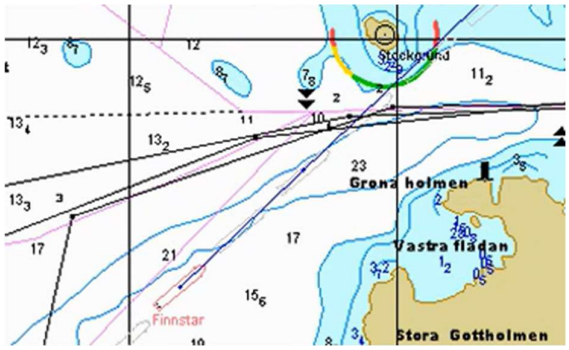


Figure 37

But then a gross mistake occurs, for which there is no other explanation than the influence of the phone. At that moment, when the course should already be about 080º, it is 050º, and the rotation speed is only 5 degrees per minute. Speed is 17 knots (Figure 38)

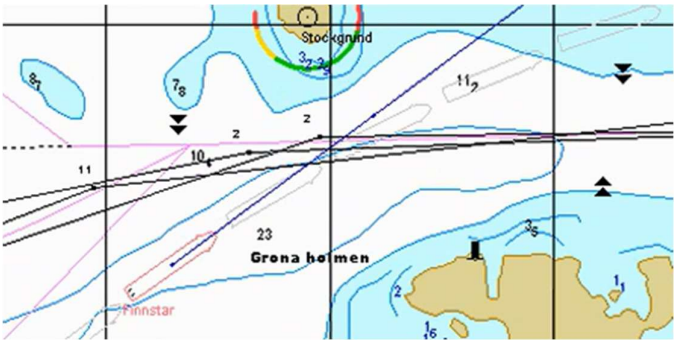


Figure 38

This way Finnstar comes on the left side of the fairway and finds itself in a dangerous situation, but since the speed has been increased, Finnstar coming into the narrow turn earlier than Al Mukhtar. (Figure 39)

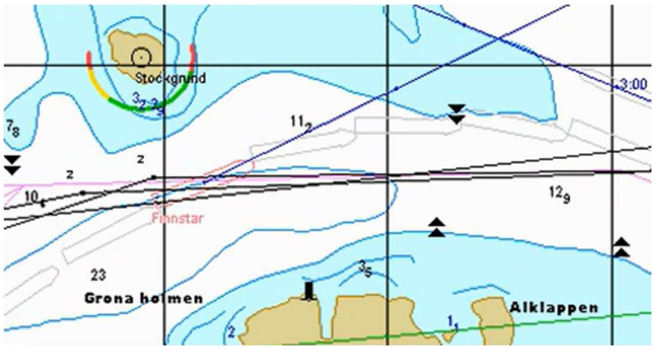


Figure 39

Now the situation is completely out of control, since Finnstar is still on the left side of the fairway, and the distance between the vessels is rapidly shrinking, now it is only 5 cables. In addition, the vessel enters prohibited waters by crossing the mark. (Figures 40, 41)

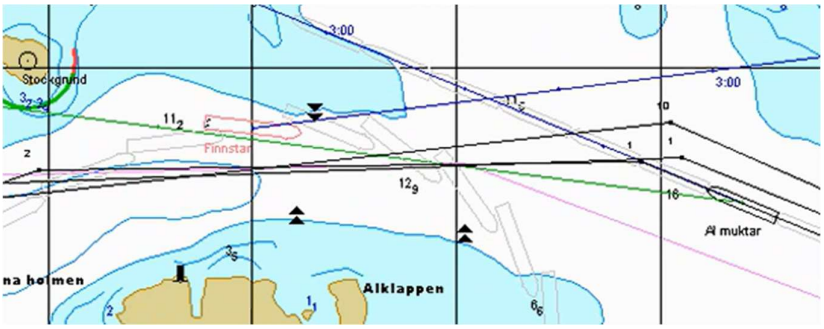


Figure 40

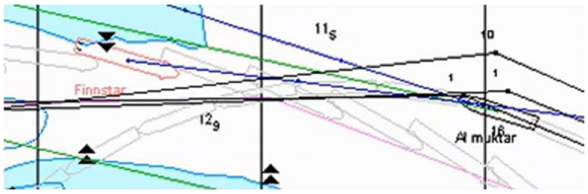


Figure 41

The collision occurs at a speed of 11 knots while trying to cross the fairway in front of Al Mukhtar. According to the participant, he noticed another vessel at the last moment, as he was distracted by phone. (Figure 42)

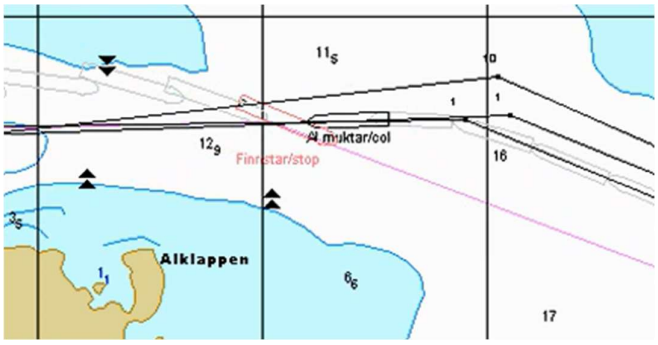


Figure 42

So, after the collision we decided to continue the experiment so that all participants go trough it to the end. Third participant starts the turn on time, if at that moment two ships were in this fairway, there would be enough space for both. ROT is 18 degrees per minute, SOG is 12 knots. (Figure 43)

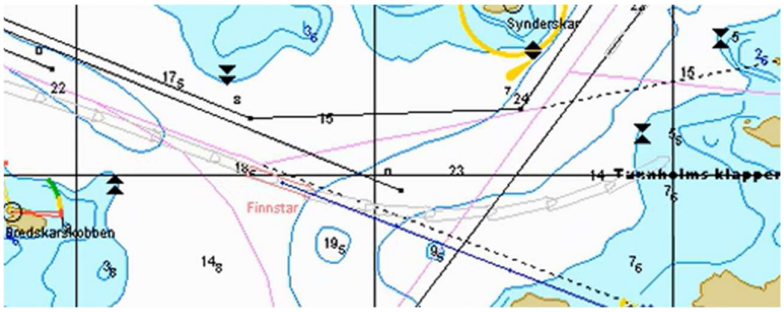


Figure 43

But then we see that this ROT is not enough and there is a risk of running aground, speed is reduced to 9 knots. (Figure 44)

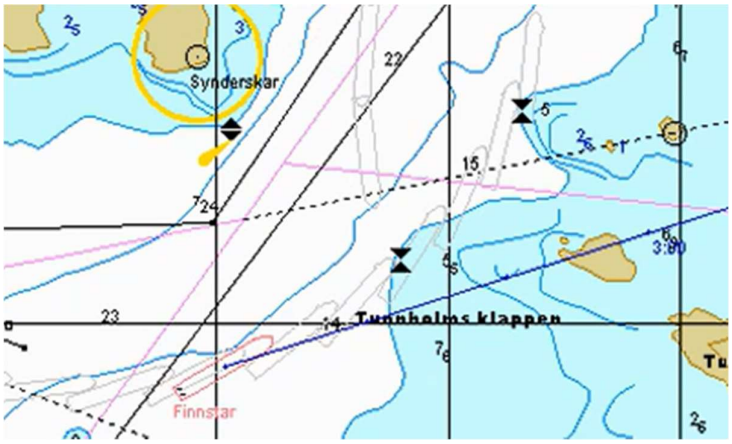


Figure 44

As a result of exiting the turn too early, the vessel entered the danger gone, there wsr a risk of grounding. (Figure 45)

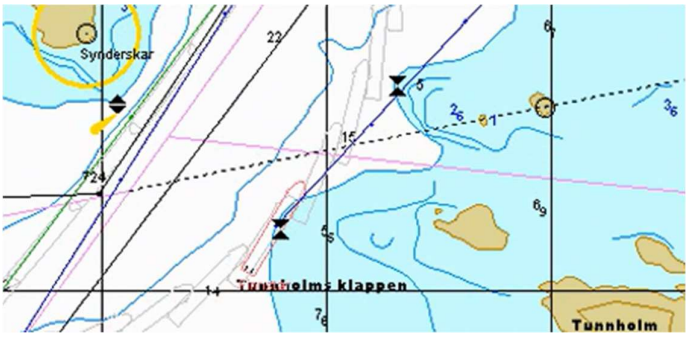


Figure 45

This mistake was also made by the first participant, now it is necessary to reach the optimal course for the third turn, but third participant does not cope with this task. (Figure 46)

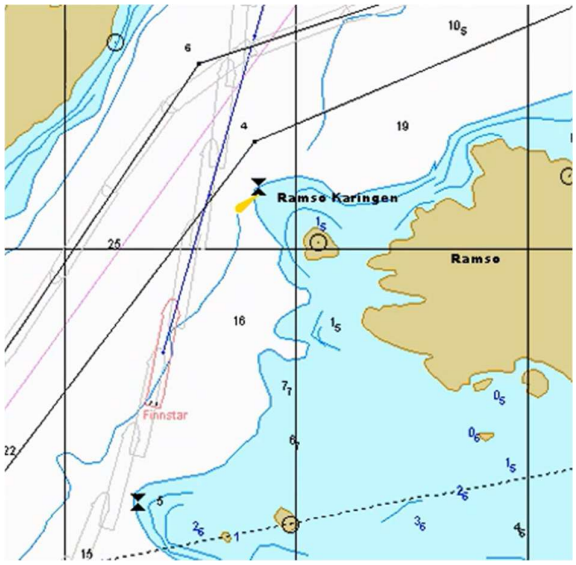


Figure 46

After passing the mark, the course should already be about 070°, but it is only 022°. (Figure 47)

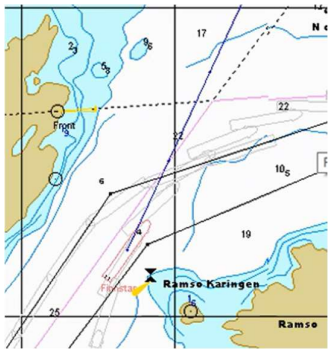


Figure 47

As a result, Finnstar enters the left side of the fairway, making another navigational mistake. (Figure 48)

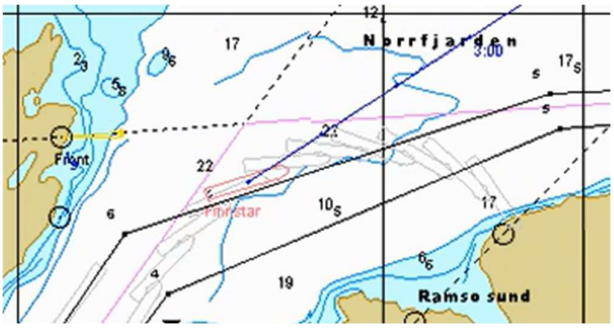


Figure 48

After that turn nothing interesting from the point of my research happened, third participant coped with the rest of route without any problems like other participants.

5.6.1 Conclusions from the results of the third participant

From the beginning of the route navigator showed confident control, but control was almost immediately lost at the first turn, as a result of which the vessel was about grounding, and then there was a collision with another vessel, since the navigator, distracted by the phone, did not see the danger until the last moment. And also, two mistakes between second and third turns, with risk of grounding and risk of collision if there would be another vessel. Number of mistakes-4. One of them is critical.

5.7 Conclusions from the experiment

At first, I would like to say that my expectations about the experiment were mostly justified. I built the experiment in such a way that the influence of the phone was three-stage, starting from zero, and ending with complete. The first moment requiring increased concentration immediately showed that only those who were not subject to distractions successfully passed it. Further, with the rest of the participants, the number of mistakes, and their price went up. The participant, for whom the influence of the phone was about 50 percent, made three mistakes, one of which could be grounding. The participant, who was maximally distracted by the phone, made critical mistake of colliding with another vessel. In real life, this would most likely lead to job loss for the navigator and huge money problems for the shipping company. In addition, he made several other mistakes that could lead to grounding.

The experiment clearly demonstrated that even a partial influence of the phone on the attention of the navigator can lead to accidents. Everyone is at risk, regardless of experience, as confirmed in the cases that I described at the beginning of my research.

6 Conclusions from the research

Although the topic of my research may initially seem useless, or obvious, I felt it necessary to carry it out, and get results, that I hope will be useful. At the beginning of my study, I thought that I would not be able to find much material regarding cases in real life, however, rather unfortunately, they turned out to be more than enough to understand that the problem I was researching really exists. I decided to focus on the attention of the navigator, although the field for research could be wider, but it is the attention, or rather its lack in ship navigation, that leads to serious consequences. I believe that is very important to draw the attention of seafarers to the dangers of gadgets while navigating the ship, and during cargo operations. Many companies prohibit the use of gadgets during working hours, but incidents still happen, as some seafarers are rather negligent in following the crew manuals.

In my research, I clearly showed the difference between a sailor who does not use a gadget and sailors who are distracted by it of varying severity, as far as possible, during the navigation. It can be said that the conclusion of my research was obvious from the beginning, but it is possible to think that the phone affects peoples in different ways, and by my research it becomes clear that absolutely anyone is at risk of losing control of the situation when using their gadgets during important ship operations.

Based on the foregoing, I can say, that the only correct conclusion that can be drawn is to leave gadgets in the cabin for the duration of the watch, regardless of position and position responsibilities.

7 References

Board, N. T. (2017 , 04 03). *Collision of Bulk Carrier Aris T with Tank Barge WTC 3019,.* Retrieved from http://www.ntsb.gov: https://www.ntsb.gov/investigations/AccidentReports/Reports/MAB1701.pdf

Branch, M. A. (2005, 02). Retrieved from https://assets.publishing.service.gov.uk: https://assets.publishing.service.gov.uk/media/547c70b9e5274a428d0000bf/Attilio_Ievoli.pdf

Branch, M. A. (2020, 06). Retrieved from https://assets.publishing.service.gov.uk/: https://assets.publishing.service.gov.uk/media/5ee08229e90e07141fd1a990/2020-10-SeatruckProgress.pdf

Chholak, P. (2020, 12 22). *Voluntary and Involuntary Attention in Bistable Visual Perception: A MEG Study.* Retrieved from Frontiers in human neuroscience: https://www.frontiersin.org/articles/10.3389/fnhum.2020.597895/full#h1

Guard, U. S. (2022, 12 01). *Report of the Investigation.* Retrieved from https://www.dco.uscg.mil/: https://www.dco.uscg.mil/Portals/9/DCO%20Documents/5p/CG-5PC/INV/docs/documents/EverForwardGrounding_ROI_Redacted.pdf?ver=oddDgOSiBdmfRW2gXWrdnEQ%3D%3D

Ward, A. (2017, 06 26). *The Mere Presence of Your Smartphone Reduces Brain Power, Study Shows*. Retrieved from UT news: https://news.utexas.edu/2017/06/26/the-mere-presence-of-your-smartphone-reduces-brain-power/