

Analysis and Model Evaluation of Unsafe Behavior of Seafarers

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Abstract: With the continuous development of China's shipping industry, the importance of shipping system to the safety of navigation has been continuously improved. Safe navigation is the basis for the completion of various shipping work. As the direct participants in shipping work, whether the navigators' behavior is scientific and compliant will affect the safety of the whole shipping system to a great extent. Based on the reality of shipping work, this paper analyzes the unsafe behavior of seafarers, and designs and discusses the safety behavior evaluation model of seafarers, aiming to provide some ideas and suggestions for improving the safety of shipping work.

Keywords: Seafarers, unsafe behavior, model evaluation.

1. INTRODUCTION

As a direct participant in shipping work, the behavior and consciousness of seafarers will directly affect the safety of the shipping system. With the continuous development of navigation industry, shipping work has put forward higher requirements for safety. According to the analysis of all kinds of maritime accidents in the past, most of the causes of the accidents are unsafe behaviors of the navigators. In order to ensure the safety of shipping work and improve the safety awareness of seafarers, it is necessary to sort out the unsafe behaviors of seafarers, and make safety evaluation of the behavior of seafarers by modeling method.

2. PART AND RELATIONSHIP OF SHIPPING SYSTEM

The composition of the shipping system can be divided into four parts: personnel, machinery, environment and management. The four parts complement each other, influence each other and work together to form a shipping system. Personnel here refers to all the crew on board the ship, including front-line staff and managers, who are the organizers and carriers of the shipping work; here is a general concept of machinery, including ships, machinery and cargo; the environment here mainly contains two aspects, namely, the navigation environment of the ship. And the ship's environment; the management here also includes two parts: ship's management personnel and management system. The components and relationships of the shipping system can be expressed in the following diagram:

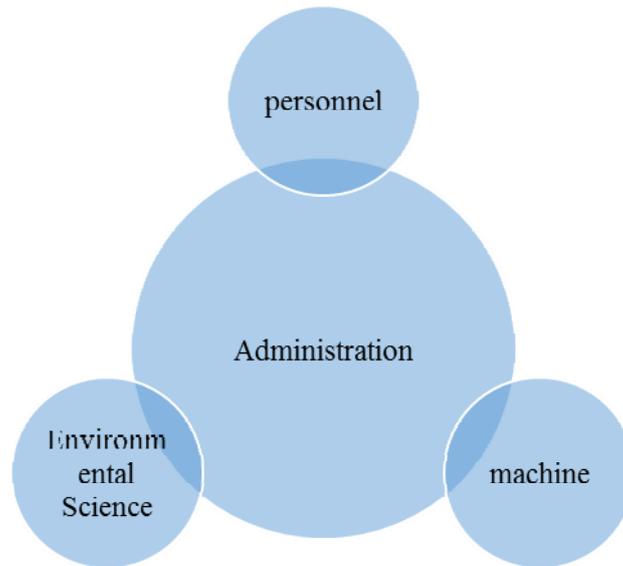


Fig 1. Components of ships and their relationship

Among these four elements, environment and machine are objective factors, which can be managed and controlled by navigators. In other words, seafarers have the initiative to reduce the risk of navigation by their own actions.

3. ANALYSIS OF UNSAFE BEHAVIOR OF SEAFARERS

3.1 Unsafe behaviors that may arise in navigational environment

Compared with other working environments, the environment on the ship has a certain particularity. Working on the ship for a long time, the physiological and psychological characteristics of seafarers will change. The environmental factors that need to be considered when navigating at sea are weather, sea condition, wind speed, etc. When encountering harsh environment, the navigators should pay more attention and be cautious in sailing. Generally speaking, it is easy to lead to physical and mental fatigue of navigators on the sea. In most cases, it is necessary to reverse the jet lag, which further aggravates the physiological and psychological load of navigators. Seafarers who are physically and mentally tired are apt to lead to inattention, irritability and anger at work, which brings certain risks to sailing. In addition, the relatively monotonous living and social environment on the ship, which is easy to lead to depression in the mood of sailors, unable to concentrate on driving, to bring potential risks to the ship.

3.2 Unsafe behavior in information analysis and processing

Mariners are professionally trained technicians who need to use their expertise and experience to deal with various situations during the voyage. However, the analysis and processing of external information is a phased process, in this process, if a link is wrong, it may lead to the final wrong behavior. For example, in the process of driving, it is found that the speed is too fast will collide with the front car, whether it is emergency braking or steering avoidance, which requires the driver to take appropriate measures according to the actual situation.

Similarly, in the course of sailing a ship, if there is a mistake in the information analysis and processing of the navigators, it may lead to collision of the ship. Generally speaking, the analysis and processing of human information can be represented by the following pictures.

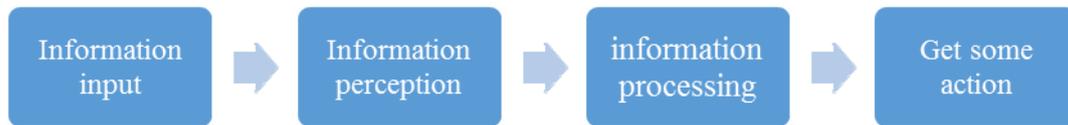


Fig 2. Human information analysis and processing process

3.3 The physical and mental quality of seafarers will easily lead to unsafe behavior.

Navigation is a work with strong physical and mental quality requirements. Long-term navigation at sea requires navigators to develop a strong physique and maintain good physical and mental quality. Generally speaking, the work load and intensity of navigation at sea are large, and the long-term work is easy to lead to the decline of the physical and mental quality of navigators. Therefore, before each voyage begins, the navigators are required to carry out the necessary physical and mental examination, but most of the time the inspection does not play a substantive role, it is difficult to protect the physical and mental quality of the navigators to maintain a good state. The seafarers with poor physical and mental quality often show fatigue, inattention, rigidity and dullness in their work. The decline of seafarers' physical and mental qualities is another important factor that leads to unsafe behaviors. It is very important to pay close attention to and protect the physical and mental qualities of seafarers.

4. SAFETY BEHAVIOR MODEL EVALUATION OF SEAFARERS

4.1 The safety behavior factors of seafarers are selected to build a model for evaluation.

The article selects four behavioral indicators to build the model. First, indicators of physical and mental health of seafarers. Good physical quality is essential to the stable development of navigation work, lack of strong body, it is difficult to adapt to the more difficult navigation life. The unpredictable natural environment at sea puts forward certain requirements for the physiological quality of seafarers; in the theory of navigation, psychological quality will have an important impact on the operation of seafarers, especially for some key positions of seafarers, their psychological quality will greatly affect the safety of ships. Sex (is it possible to handle calmly when facing a crisis)? Second, the professional skills of seafarers. The professional skills of seafarers are the basis for navigational work and coping with various situations. Professional skills mainly include two aspects: professional knowledge and skills. Third, safety awareness index for seafarers. Safety consciousness is a kind of thinking consciousness that every navigator should possess. Only when he has enough safety

consciousness can he keep alert and eliminate potential risks. Fourth, seafarers' offshore working experience indicators. Navigation is a relatively practical work, and having rich experience in navigation is very valuable for a navigator. Experienced and able to keep calm and avoid danger when sailing in a sudden situation.

4.2 Neural network evaluation model construction

The actual quantity measured by the evaluation index is normalized, and the value obtained after normalization is used as the input vector of the neural network model; the evaluation result is used as the output vector of the neural network model; and several (enough vectors) are used to practice the network model to get the weight of each index. The structure of the model is shown in the following figure:

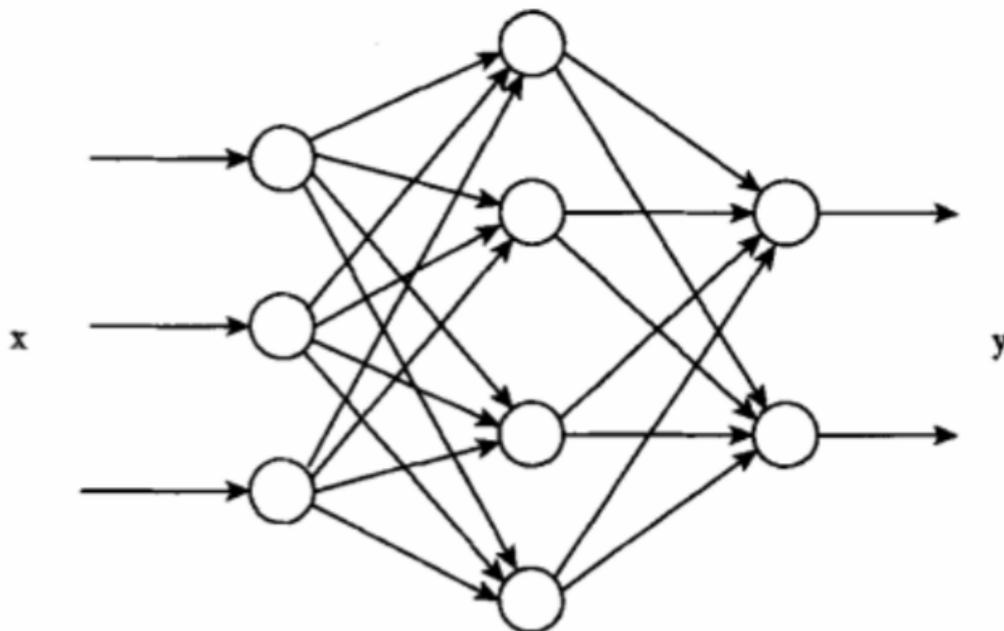


Fig 3. Neural network evaluation model structure

Among them, X and y are input vectors and output vectors of the model respectively. The model consists of three parts: input layer node, output layer node and hidden layer node. In the evaluation system of neural network model, the eigenvalue of each vector is usually lack of quantitative description, but it is more quantifiable to control the eigenvalue of each vector in the range of $[0, 1]$ in the comprehensive evaluation of the model. The higher the score of the output vector, the higher the index's security is. The research on neural network model is still in the exploratory stage, so it is necessary to do further research and exploration to determine the number of nodes in the network model.

5. SUMMARY

In summary, this paper first explains the four components of the shipping system - personnel, machinery, environment and management. Then it explores the unsafe behavior of seafarers, which is mainly manifested by unsafe behavior caused by the navigation environment, unsafe behavior caused by information processing errors and unsafe behavior caused by the decline of

physical and mental quality of seafarers. This paper establishes a model of physical and mental health, professional skills, and safety awareness and navigation experience. Improving the scores of the four indicators can effectively improve navigation safety.

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