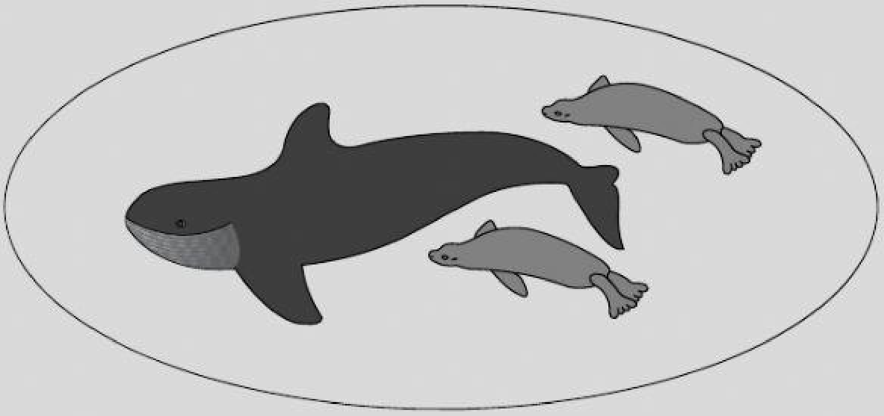
READING PASSAGE 2

*You should spend about 20 minutes on **Questions 15–26** which are based on Reading Passage 2 below.*

What Do Whales Feel?

An examination of the functioning of the senses in cetaceans, the group of mammals comprising whales, dolphins and porpoises



Some of the senses that we and other terrestrial mammals take for granted are either reduced or absent in cetaceans or fail to function well in water. For example, it appears from their brain structure that toothed species are unable to smell. Baleen species, on the other hand, appear to have some related brain structures but it is not known whether these are functional. It has been speculated that, as the blowholes evolved and migrated to the top of the head, the neural pathways serving sense of smell may have been nearly all sacrificed. Similarly, although at least some cetaceans have taste buds, the nerves serving these have degenerated or are rudimentary.

The sense of touch has sometimes been described as weak too, but this view is probably mistaken. Trainers of captive dolphins and small whales often remark on their animals' responsiveness to being touched or rubbed, and both captive and free-ranging cetacean individuals of all species (particularly adults and calves, or members of the same subgroup) appear to make frequent contact. This contact may help to maintain order within a group, and stroking or touching are part of the courtship ritual in most species. The area around the blowhole is also particularly sensitive and captive animals often object strongly to being touched there.

The sense of vision is developed to different degrees in different species. Baleen species studied at close quarters underwater – specifically a grey whale calf in captivity for a year, and free-ranging right whales and humpback whales studied and filmed off Argentina and Hawaii – have obviously tracked objects with vision underwater, and they can apparently see moderately well both in water and in air. However, the position of the eyes so restricts the field of vision in baleen whales that they probably do not have stereoscopic vision.

On the other hand, the position of the eyes in most dolphins and porpoises suggests that they have stereoscopic vision forward and downward. Eye position in freshwater dolphins, which often swim on their side or upside down while feeding, suggests that what vision they have is stereoscopic forward and upward. By comparison, the bottlenose dolphin has extremely keen vision in water. Judging from the way it watches and tracks airborne flying fish, it can apparently see fairly well through the air–water interface as well. And although preliminary experimental evidence suggests that their in-air vision is poor, the accuracy with which dolphins leap high to take small fish out of a trainer's hand provides anecdotal evidence to the contrary.

Such variation can no doubt be explained with reference to the habitats in which individual species have developed. For example, vision is obviously more useful to species inhabiting clear open waters than to those living in turbid rivers and flooded plains. The South American boutu and Chinese beiji, for instance, appear to have very limited vision, and the Indian susus are blind, their eyes reduced to slits that probably allow them to sense only the direction and intensity of light.

Although the senses of taste and smell appear to have deteriorated, and vision in water appears to be uncertain, such weaknesses are more than compensated for by cetaceans' well-developed acoustic sense. Most species are highly vocal, although they vary in the range of sounds they produce, and many forage for food using echolocation[1]. Large baleen whales primarily use the lower frequencies and are often limited in their repertoire. Notable exceptions are the nearly song-like choruses of bowhead whales in summer and the complex, haunting utterances of the humpback whales. Toothed species in general employ more of the frequency spectrum, and produce a wider variety of sounds, than baleen species (though the sperm whale apparently produces a monotonous series of high-energy clicks and little else). Some of the more complicated sounds are clearly communicative, although what role they may play in the social life and 'culture' of cetaceans has been more the subject of wild speculation than of solid science.

1. echolocation: the perception of objects by means of sound wave echoes.

Questions 15–21

Complete the table below.

Choose ***NO MORE THAN THREE WORDS*** *from Reading Passage 2 for each answer.*

Write your answers in boxes 15–21 on your answer sheet.

SENSE	SPECIES	ABILITY	COMMENTS
Smell	toothed	no	evidence from brain structure
	baleen	not certain	related brain structures are present
Taste	some types	poor	nerves linked to their **15**………… are underdeveloped
Touch	all	yes	region around the blowhole very sensitive
Vision	**16**…………	yes	probably do not have stereoscopic vision
	dolphins, porpoises	yes	probably have stereoscopic vision **17**………… and …………
	18…………	yes	probably have stereoscopic vision forward and upward
	bottlenose dolphin	yes	exceptional in **19**………… and good in air–water interface
	boutu and beiji	poor	have limited vision
	Indian susu	no	probably only sense direction and intensity of light
Hearing	most large baleen	yes	usually use **20**…………; repertoire limited
	21………… whales and ………… whales	yes	song-like
	toothed	yes	use more of frequency spectrum; have wider repertoire

Questions 22–26

Answer the questions below using ***NO MORE THAN THREE WORDS*** *from the passage for each answer.*

Write your answers in boxes 22–26 on your answer sheet.

22 Which of the senses is described here as being involved in mating?

23 Which species swims upside down while eating?

24 What can bottlenose dolphins follow from under the water?

25 Which type of habitat is related to good visual ability?

26 Which of the senses is best developed in cetaceans?

READING PASSAGE 3

You should spend about 20 minutes on ***Questions 27–40*** *which are based on Reading Passage 3 below.*

Visual Symbols and the Blind

Part 1

From a number of recent studies, it has become clear that blind people can appreciate the use of outlines and perspectives to describe the arrangement of objects and other surfaces in space. But pictures are more than literal representations. This fact was drawn to my attention dramatically when a blind woman in one of my investigations decided on her own initiative to draw a wheel as it was spinning. To show this motion, she traced a curve inside the circle (*Fig. 1*). I was taken aback. Lines of motion, such as the one she used, are a very recent invention in the history of illustration. Indeed, as art scholar David Kunzle notes, Wilhelm Busch, a trend-setting nineteenth-century cartoonist, used virtually no motion lines in his popular figures until about 1877.

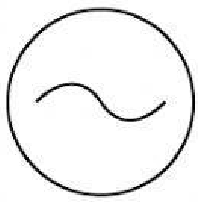


Fig. 1

When I asked several other blind study subjects to draw a spinning wheel, one particularly clever rendition appeared repeatedly: several subjects showed the wheel's spokes as curved lines. When asked about these curves, they all described them as metaphorical ways of suggesting motion. Majority rule would argue that this device somehow indicated motion very well. But was it a better indicator than, say, broken or wavy lines – or any other kind of line, for that matter? The answer was not clear. So I decided to test whether various lines of motion were apt ways of showing movement or if they were merely idiosyncratic marks. Moreover, I wanted to discover whether there were differences in how the blind and the sighted interpreted lines of motion.

To search out these answers, I created raised-line drawings of five different wheels, depicting spokes with lines that curved, bent, waved, dashed and extended beyond the perimeter of the wheel. I then asked eighteen blind volunteers to feel the wheels and assign one of the following motions to each wheel: wobbling, spinning fast, spinning steadily, jerking or braking. My control group consisted of eighteen sighted undergraduates from the University of Toronto.

All but one of the blind subjects assigned distinctive motions to each wheel. Most guessed that the curved spokes indicated that the wheel was spinning steadily; the wavy spokes, they thought, suggested that the wheel was wobbling; and the bent spokes were taken as a sign that the wheel was jerking. Subjects assumed that spokes extending beyond the wheel's perimeter signified that the wheel had its brakes on and that dashed spokes indicated the wheel was spinning quickly.

In addition, the favoured description for the sighted was the favoured description for the blind in every instance. What is more, the consensus among the sighted was barely higher than that among the blind. Because motion devices are unfamiliar to the blind, the task I gave them involved some problem solving. Evidently, however, the blind not only figured out meanings for each line of motion, but as a group they generally came up with the same meaning at least as frequently as did sighted subjects.

Part 2

We have found that the blind understand other kinds of visual metaphors as well. One blind woman drew a picture of a child inside a heart – choosing that symbol, she said, to show that love surrounded the child. With Chang Hong Liu, a doctoral student from China, I have begun exploring how well blind people understand the symbolism behind shapes such as hearts that do not directly represent their meaning.

We gave a list of twenty pairs of words to sighted subjects and asked them to pick from each pair the term that best related to a circle and the term that best related to a square. For example, we asked: What goes with soft? A circle or a square? Which shape goes with hard?

All our subjects deemed the circle soft and the square hard. A full 94% ascribed happy to the circle, instead of sad. But other pairs revealed less agreement: 79% matched fast to slow and weak to strong, respectively. And only 51% linked deep to circle and shallow to square. (See *Fig. 2.*) When we tested four totally blind volunteers using the same list, we found that their choices closely resembled those made by the sighted subjects. One man, who had been blind since birth, scored extremely well. He made only one match differing from the consensus, assigning 'far' to square and 'near' to circle. In fact, only a small majority of sighted subjects – 53% – had paired far and near to the opposite partners. Thus, we concluded that the blind interpret abstract shapes as sighted people do.

Words associated with circle/square	Agreement among subjects (%)
SOFT-HARD	**100**
MOTHER-FATHER	**94**
HAPPY-SAD	**94**
GOOD-EVIL	**89**
LOVE-HATE	**89**
ALIVE-DEAD	**87**
BRIGHT-DARK	**87**
LIGHT-HEAVY	**85**
WARM-COLD	**81**
SUMMER-WINTER	**81**
WEAK-STRONG	**79**
FAST-SLOW	**79**
CAT-DOG	**74**
SPRING-FALL	**74**
QUIET-LOUD	**62**
WALKING-STANDING	**62**
ODD-EVEN	**57**
FAR-NEAR	**53**
PLANT-ANIMAL	**53**
DEEP-SHALLOW	**51**

***Fig. 2** Subjects were asked which word in each pair fits best with a circle and which with a square. These percentages show the level of consensus among sighted subjects.*

Questions 27–29

Choose the correct letter, ***A****,* ***B****,* ***C*** *or* ***D****.*

Write your answers in boxes 27–29 on your answer sheet.

27 In the first paragraph the writer makes the point that blind people

A may be interested in studying art.
B can draw outlines of different objects and surfaces.
C can recognise conventions such as perspective.
D can draw accurately.

28 The writer was surprised because the blind woman

A drew a circle on her own initiative.
B did not understand what a wheel looked like.
C included a symbol representing movement.
D was the first person to use lines of motion.

29 From the experiment described in Part 1, the writer found that the blind subjects

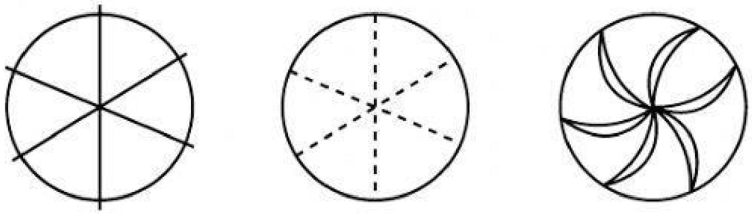
A had good understanding of symbols representing movement.
B could control the movement of wheels very accurately.
C worked together well as a group in solving problems.
D got better results than the sighted undergraduates.

Questions 30–32

Look at the following diagrams (Questions 30–32), and the list of types of movement below.

Match each diagram to the type of movement ***A–E*** *generally assigned to it in the experiment.*

Choose the correct letter ***A–E*** *and write them in boxes 30–32 on your answer sheet.*



30 **31** **32**

A	steady spinning
B	jerky movement
C	rapid spinning
D	wobbling movement
E	use of brakes

Questions 33–39

Complete the summary below using words from the box.

Write your answers in boxes 33–39 on your answer sheet.

NB *You may use any word more than once.*

In the experiment described in Part 2, a set of word **33**…… was used to investigate whether blind and sighted people perceived the symbolism in abstract **34**…… in the same way. Subjects were asked which word fitted best with a circle and which with a square. From the **35**…… volunteers, everyone thought a circle fitted 'soft' while a square fitted 'hard'. However, only 51% of the **36**…… volunteers assigned a circle to **37**…… . When the test was later repeated with **38**…… volunteers, it was found that they made **39**…… choices.

associations	blind	deep	hard
hundred	identical	pairs	shapes
sighted	similar	shallow	soft
words			

Question 40

Choose the correct letter, ***A****,* ***B****,* ***C*** *or* ***D****.*

Write your answer in box 40 on your answer sheet.

Which of the following statements best summarises the writer's general conclusion?

A The blind represent some aspects of reality differently from sighted people.
B The blind comprehend visual metaphors in similar ways to sighted people.
C The blind may create unusual and effective symbols to represent reality.
D The blind may be successful artists if given the right training.