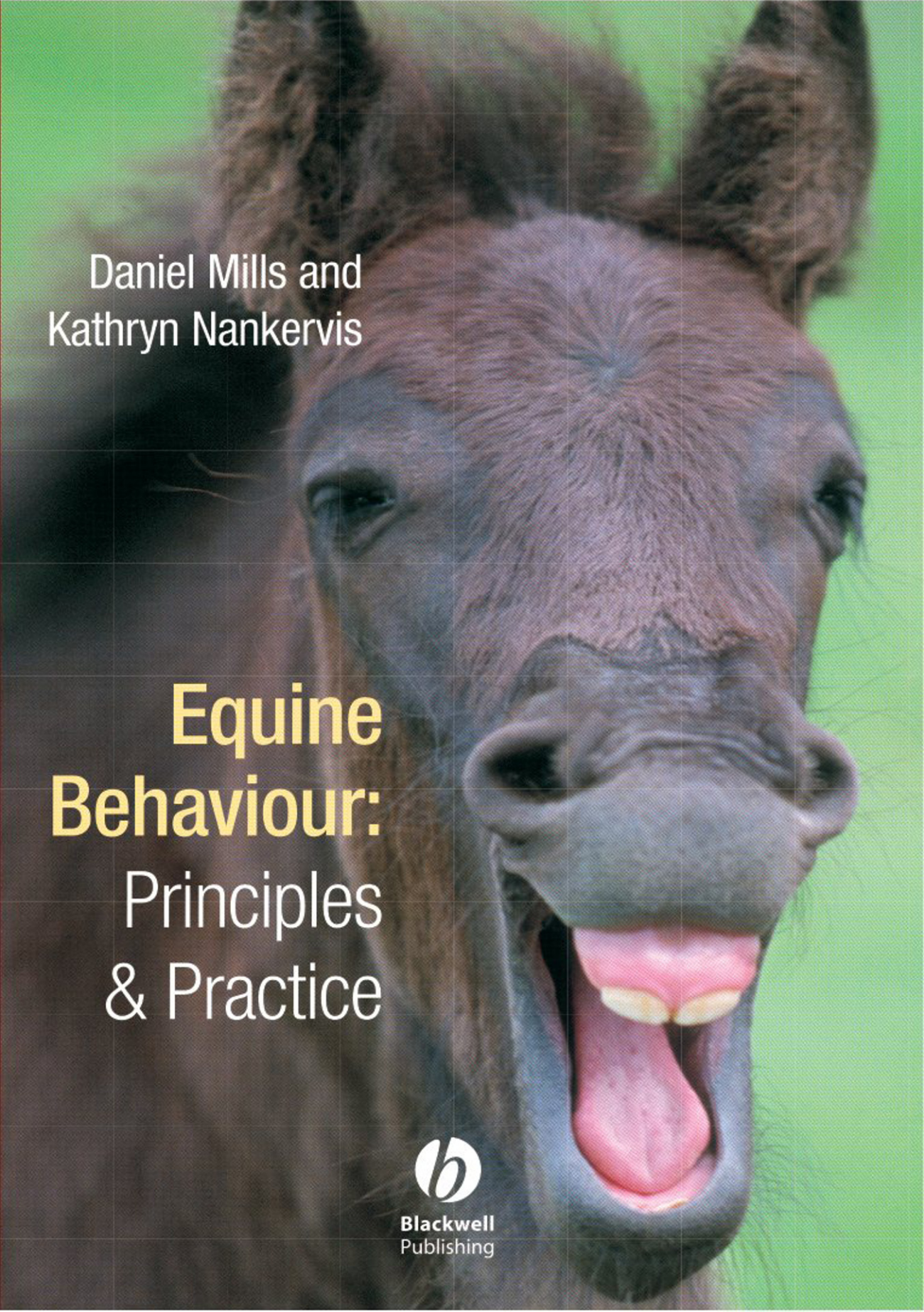


Daniel Mills and
Kathryn Nankervis

Equine Behaviour: Principles & Practice

Blackwell
Publishing

Equine Behaviour: Principles and Practice

D.S. Mills
and
K.J. Nankervis

Blackwell
Science

Editorial Offices:
Blackwell Science Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK
Tel: +44 (0) 1865 776868
Blackwell Publishing Professional, 2121 State Avenue, Ames, Iowa, 50014-8300, USA
Tel: +1 515 292 0140
Blackwell Science Asia Pty Ltd, 550 Swanston Street, Carlton, Victoria 3053, Australia
Tel: +61 (0)3 8359 1011

First published 1999

12 2009

ISBN: 978-0-6320-4878-6

Library of Congress Cataloging-in-Publication Data
Mills, D.S.
Equine behaviour:principles and practice/D.S. Mills and K.J. Nankervis.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-6320-4878-6 (pbk.)
1. Horses—Behavior. I. Nankervis, K.J. II. Title
SF281.M58 1999
636.1—dc21
98-55558
CIP

A catalogue record for this title is available from the British Library

Set in 10.5/12.5 pt Palatino
by DP Photosetting, Aylesbury, Bucks
Printed and bound in Malaysia by KHL Printing Co Sdn Bhd

The publisher's policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp processed using acid-free and elementary chlorine-free practices. Furthermore, the publisher ensures that the text paper and cover board used have met acceptable environmental accreditation standards.

For further information on Blackwell Publishing, visit our website:
www.blackwellpublishing.com

Contents

Preface

Almost everyone who feels qualified to call himself or herself a horse-person will have studied equine behaviour to a certain extent. Initial interest in equine behaviour often arises when we have a problem and ask 'Why won't my horse do what I want it to do?' Thereafter, naturally, the study of equine behaviour is motivated from a 'How can I get it to do what I want?' standpoint. It is very easy, then, to look for 'recipes' which sort out the current problem but which fail to address the underlying, often fundamental issue.

The answer to our first question may simply be 'because it is a horse'. If only we were to understand what being a horse is about, then we would recognise that the problem lies with us, either in our approach to a situation, or in our expectations of the horse. We must learn to accept that, however knowledgeable we are in the business of training horses, we cannot get around the fact that our two species have fundamental differences in priorities. If we insist then, on riding on and competing with horses, we should strive to do it to the best of our ability, so that both parties come out feeling like winners. Xenophon summed it up bluntly two and a half thousand years ago when he wrote:

> 'Seeing that you are forced to meddle with horses, don't you think that common sense requires you to see that you are not ignorant of the business?'

It is hoped that this book will go some way towards addressing this need, in a perhaps light-hearted fashion that nevertheless should not belie the basic seriousness of the concern we should all feel for the welfare of the horses in our care.

D.S. Mills
De Montfort University

K.J. Nankervis
Newmarket

August 1998

Acknowledgements

This book is based on lectures given by us to De Montfort University students over the last few years. It therefore owes a lot to them for their comments on what were, in effect, practice drafts of the original text. We are also grateful to Christine Nicol, Debbie Goodwin and Jonathan Cooper for comments on an earlier draft of the text. We would also like to thank our publishers for their support (and patience) during the book's production, and Tamsin Bacchus for her work in copy editing the text. Finally, we would also like to thank our partners, Connie and Tom, for all their help throughout.

This book is dedicated to everyone who has a serious interest in improving the welfare of horses, through a better understanding of their behaviour.

Part 1
Understanding Behaviour Concepts

In this section we introduce the principles behind the study and interpretation of animal behaviour. Anyone can watch animal behaviour but that is not the same as making a scientific study of it. In order to do this, we must understand and apply certain rules. An explanation of these helps us to understand why a horse behaves in a certain way, as well as why it does not behave in another way (the limits of its behaviour). These limitations are just as important when we consider how we should manage our horse best. With such understanding we are also in a position to test our own ideas scientifically with either field or laboratory experiments. This is the way in which scientific knowledge increases and our understanding of the needs of the horse improves.

1. *Approaches to the Study of Behaviour*

We may be motivated in our study of behaviour by the hope that we can improve the performance of our own horse in some particular way, seeking to make it do what we want, but in studying horse behaviour and its origins and management in general terms, we should not forget that not all horses are winners. You may be disappointed that the horse you had high hopes for turns out to be completely talentless, despite your strenuous efforts to 'understand' him. The problem may not lie with the method used, but with the potential of the horse. In other words, the horse's behaviour is a product of both its biology and its environment or 'nature and nurture', as many people call it. We should not get so wrapped up in our role in 'nurturing', that we forget about the 'nature' of horses in general and that horse in particular.

What is behaviour?

Behaviour is what living animals do, and what dead animals don't do. Behaviour is an expression of physiology. There are two broad ways in which we tend to describe behaviour:

(1) We can detail the physical actions involved in a behaviour; how one part moves relative to either another part of the body or the environment. For example, we might say that a horse has extended its foreleg, or that it is galloping.
(2) Alternatively we may describe the consequences of the behaviour or the suspected aim. For example, we might say that one horse is threatening or attacking another. This will often involve an element of interpretation, which can cause problems.

A horse dozing in a field is performing just as much behaviour as a horse that is fighting, riding a bike, or turning somersaults! These are all complex actions which involve the integration of several behavioural acts. The mechanism that allows a horse to sleep

standing up is, in itself, a really neat piece of engineering. Contrary to popular belief, however, horses still need to spend a certain amount of time lying down in order to sleep properly. Management can have an effect on even this. Houpt (1991) reports that horses which are usually stabled sleep less for the first month after turn out, and do not even get down to sleep on the first night. Since sleep is essential for the normal functioning of an animal during its waking hours we should not be surprised if the performance of the horse is affected by such a management change. This simple example highlights an important theme: we cannot understand an animal's behaviour without referring to its environment. Horses do certain things in certain environments.

Why do horses gallop?

Niko Tinbergen pointed out that if we wanted to know why an animal performs a certain behaviour, there are always four very different, but equally correct answers. For example, if we ask the question, 'why do horses gallop?' the answer could be:

◇ 'Because nerve impulses from the brain and spinal cord lead to muscle contraction in a co-ordinated way to bring about the galloping gait'.

We could go even further by saying that the nerve impulses and muscle contractions occurred because of certain physiological and biochemical changes, and give a string of chemical equations in order to explain why the horse was galloping. This is the most basic answer, looking at the horse as though it were a piece of machinery. This answer, where the idea is to try and explain the behaviour in terms of its immediate cause and control, explains the causation of behaviour.

◇ 'Because during its early development the foal learned how to co-ordinate its limbs and body to allow it to gallop'.

This approach is to explain the behaviour in terms of the developmental history (the ontogeny) of the behaviour within an individual.

◇ 'Because, over millions of years, those ancient relatives of the horse which did not move so quickly and efficiently lost out and left no descendants. Horses gallop because that is how they have evolved to move most efficiently at high speed.'

This explains the behaviour in terms of its development not within an animal's lifetime history but within the history of the species. The evolutionary history of a behaviour explains how it is adapted to its environment and is often referred to as its phylogeny.

◇ Because galloping is the best way for a horse to avoid a predator.'

This offers an explanation as to the function of the behaviour. The function of the behaviour tells us its survival value.

The first two answers explain how a horse manages to gallop, whilst answers three and four consider the purpose of galloping,

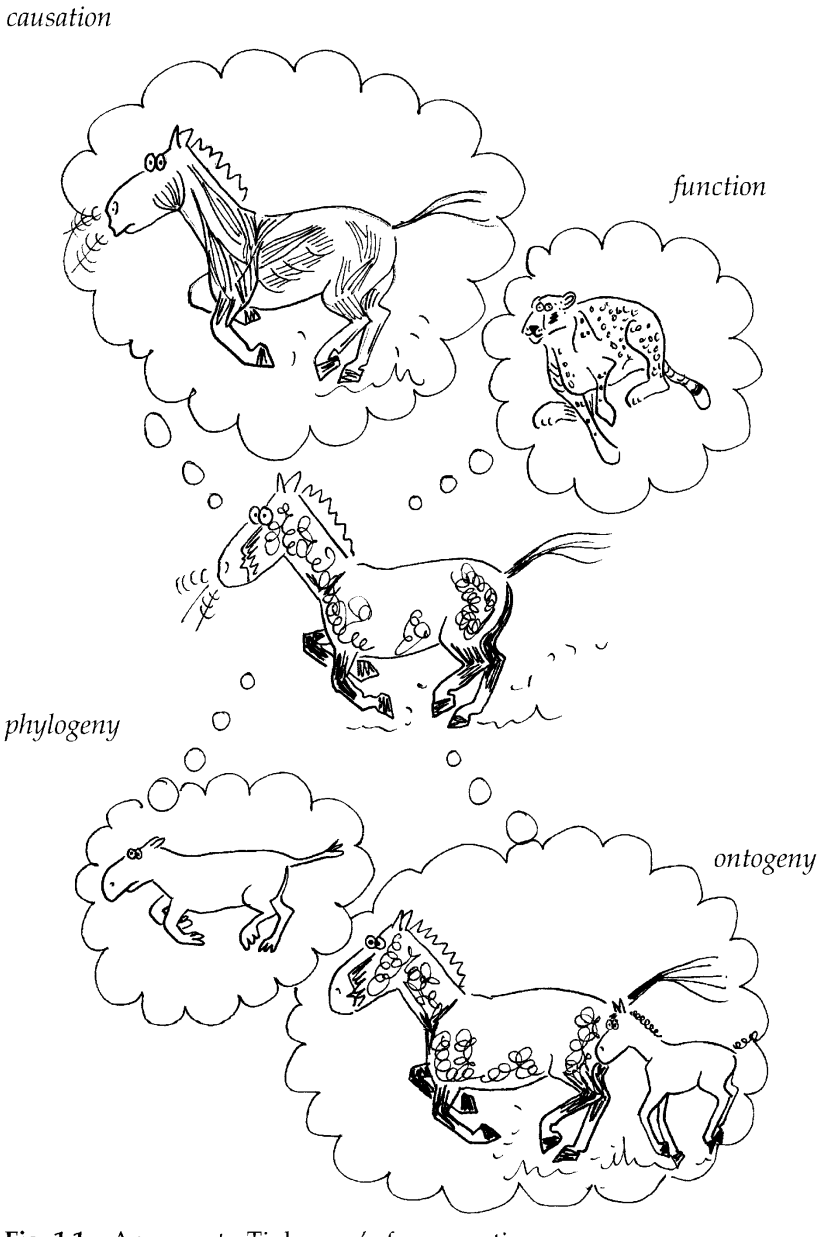


Fig. 1.1 Answers to Tinbergen's four questions.

but they are all correct. When asking ourselves 'why does...?', we must appreciate that there are several different approaches and several answers. In order to understand behaviour fully we need to recognise and understand these four different approaches.

Ethology versus psychology

The study of behaviour therefore requires the application of several biological sciences. Traditionally these have been focussed into two broad overlapping disciplines, each with a different emphasis: ethology and psychology.

The early ethologists were mainly involved with the study of wild animals in their natural environment, believing that the forces of evolution had adapted the behaviour of animals. Ethologists, therefore, tended to concentrate on those aspects of behaviour which were inherited from one generation to the next, especially the genetic aspects of behaviour. Niko Tinbergen (1952) wrote: 'Learning and many other higher processes are secondary modifications of innate mechanisms.' To him and other early ethologists the nature of inherited behaviour was its most important feature.

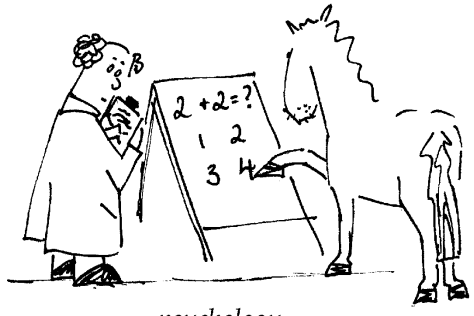
Early psychologists, on the other hand, were more interested in the development of behaviour within the individual, and concentrated on trying to establish general and universal laws affecting behaviour and how it changes with learning. In this case one species of animal was often considered as good as another for modelling the general behaviour mechanisms of animals. They tended to emphasise the importance of the environment and nurturing. This is typified by the words of one of the most famous early psychologists, John Watson:

> 'Give me a dozen healthy infants, well formed, and my own specified world to bring them up in and I'll guarantee to take any one of them at random and train him to become any specialist I might select: doctor, lawyer, merchant, chief and yes, even beggar man and thief, regardless of his talents, peculiarities, tendencies, abilities, vocations and race of his ancestors.' (Watson 1913).

Because they were interested in different aspects of behaviour ethologists and psychologists had very different ways of studying it.

In the first half of the twentieth century furious arguments raged on the nature–nurture debate: psychologists demonstrated how flexible and changeable 'instinctive' behaviours were, and ethologists showed how animals would inherently respond to certain stimuli without learning. It is only as recently as the 1970s that the

ethology



psychology

Fig. 1.2 Different approaches to the study of animal behaviour.

two sides really accepted that they were both making valid contributions, and that most progress would be made if they put their heads together.

The modern synthesis

The disciplines of psychology and ethology not only complement each other well but are inextricably linked. You cannot have behaviour without both nature and nurture. Behaviour is the consequence of the constant interaction of genetic factors with the environment; a process called epigenesis. Indeed, we could describe behaviour as a phenotypic characteristic, just like size or coat colour. Unlike other phenotypic characteristics, however, behaviour is variable on a day-to-day, or even a minute-by-minute basis.

McFarland (1993) suggests that the environment and genetics are to behaviour what length and breadth are to a field. You cannot have a field without both of these dimensions. We should resist the

temptation to talk about behaviour patterns being either genetic or learned, as if only one of these factors were important in determining behaviour. The combination of genetics and the environment sets the limits for the behaviour, just as length and breadth determine the boundaries of the field. They set the limits of an individual's ability and suggest certain predispositions. You would not go out and buy a Shetland pony from a children's farm if you had set your sights on getting round Badminton.

The constant remoulding of an animal's inherent behavioural tendencies by its environment is important from a training aspect. Horses do not just 'behave' because 'that's the way they are', they respond to their environment according to their abilities. In attempting to train the horse, we become part of its environment. This is a big responsibility, which we must be prepared to accept if we hope to be able to tap the horse's ability. We must make an effort to understand why a horse behaves in a particular way, and not just try to manipulate the results of the behaviour we see.

Techniques developed for studying behaviour in one discipline have also been borrowed by the other and resulted in great advances in our scientific understanding of behaviour. For example, the techniques used by psychologists to assess how animals respond to different rewards have been used to understand how animals naturally regulate their behaviour (see Kacelnik (1984) for experimental details). This has also helped us develop techniques to assess what is important for their well-being in captivity, as discussed in Chapter 10.

So what is behaviour?

We have already suggested that behaviour is a phenotypic feature, i.e. it is the result of the interaction between the environment and genetics at any given moment in time. We have also suggested that both the recent (proximate) and historical (ultimate) factors affecting it can be investigated. Recent factors include its immediate value and causation; historical factors include developmental issues. In both these cases behaviour is a means whereby an animal can adapt to its environment. In the short-term sense we can view behaviour as an external manifestation of internal physiology. A change is detected in the internal or external environments and this is processed by the animal which results in a change of behaviour. In order to understand behaviour, we must appreciate all these issues. With this understanding we are able to assess better how we manage horses and how we can improve. But first we must make sure that we study behaviour in a scientifically rigorous way.

A brief guide to conducting a behaviour study

The objective nature of data

Jennings, a behaviour physiologist, wrote in 1906,

> for those interested in the conscious aspects of behaviour, a presentation of the objective facts is a necessary preliminary to an intelligent discussion of the matter.

These words are not only applicable to conscious behaviour but also to any scientific study of animal behaviour. We all have our ideas as to why an animal does something in a particular way and what horses really get up to. The value of good science is that it allows us not only to offer an explanation of why something has occurred but also to predict why, when or how something is likely to recur. This means that we can prepare better for the future. Many people report their observations and feelings on all sorts of matters, but only if they are scientific can we really appreciate their true significance and compare them to other data. The scientific study of behaviour involves being as objective as possible about our observations. When we study behaviour we are interested in gathering data and this is the first of many problems we must overcome. Data are unbiased measurements. We can listen to a horse's heart and count the number of beats. The number we have is then a piece of data. If we report that the horse's heart seems a bit fast, this is not real data, but an interpretation of data. The horse may have recently run a race, have a fever, be a little nervous about us listening to its chest or just naturally have a higher than average heart rate. Only if we have more information can we interpret our data properly. It is therefore essential that we gather all the appropriate information in our study, before we discuss or try to interpret our results.

Descriptive and experimental studies

There are two broad types of behaviour study.

(1) There are those that describe and report what is happening, and so we have a record to which we may later wish to refer. This tells us what is happening in the world of horses.

(2) The second type of study is a form of experiment. We start with a question to which we want an answer. From this we think of a range of possible explanations. The aim then is to work out an experiment that would let us distinguish between them. We then gather our data and see which ideas we can discard. This does not mean that we have proved any that are left, since there may be other explanations which we had not thought of and which could not be disproved by the experiment. This is

an essential point in science which is commonly misunderstood. We do not go out to prove our ideas, we try to disprove all the alternatives.

A simple example will illustrate the point. Suppose we are interested in why horses crib-bite. We might suppose that horses do this in order to pass the time of day as there is little else for them to do in a stable (some might call this boredom). Alternatively, we might argue that they do it because they are very frustrated by being kept in the stable, particularly around meal times. At this time they can see their food but cannot get to it. We could possibly distinguish between these two explanations by giving a group of horses a toy containing food. This means that they have to work quite hard to get their ration. If the first explanation of cribbing is true then we might expect the amount of cribbing to go down when the toy is introduced. If cribbing is associated with frustration, then giving a horse a source of food which it cannot easily get to may be more frustrating. Horses are grazers and so may not be adapted to having to work for their food in the same way that a dog or cat has to. In this case we might expect the cribbing to get worse or stay the same but certainly not to get any better. An experiment somewhat similar to this has been done (Henderson *et al.* 1997). What they found was that some horses got better and others got worse. What does this tell us about why horses crib? Probably that there are several very different reasons why horses have this disturbing behaviour. Even if they had all responded the same way we could not say we now knew why horses crib. At best we could say why they probably do not.

Science can be very frustrating at times, but it can also be very exciting as you realise that there is so much that we still do not know. In this example the experimenters were measuring behaviour in order to test an idea, but whatever its purpose information needs to be gathered in a scientific manner.

Measurement

A horse's behaviour is a continuous process. As long as it is alive it is behaving. We can however divide behaviour into discrete units like galloping, chewing and kicking. When we use terms like these it may seem obvious to us what the horse is doing, but, as with any measure, like a metre, hand or second, we must ensure that we are using the term in a way which other people understand. If I say that my horse is 16 hands high then you know that it is 64 inches at the withers, even if the hand at the end of my wrist is five inches wide. That is because the term hand is defined as a four inch unit of measurement.

In behaviour there are few standard terms like the units of physics. We must therefore define the ones we use even if they seem obvious. Suppose I am interested in comparing the movement of horses around two different types of grassy paddock. I might use behaviour measures like walking, standing, trotting and grazing. Surely it is obvious what we mean by these terms? But when does grazing become standing or walking? If a horse takes three paces whilst moving to another clump of grass, is it walking or still grazing? If we say it is walking, is that the same behaviour as a horse that walks across the paddock to groom another horse? If not, then our measure is not recording anything meaningful. It is invalid.

'So what?' you might say, 'As long as I know what I've recorded, does it matter?' The answer to this in science is 'Yes: because if you can't tell me what you have measured I can't do my own study and compare results.' The value of your study is then at best limited to that experiment alone and at worst of no use at all. This could be because you were not as consistent as you thought. The definition lets everyone know exactly what you are recording and makes your observations into real data. We could test how consistent your observations are by videoing a bit of behaviour and asking you to record from it several times. If you have a good measure then you are likely to produce similar results each time. Your measure can then be said to be reliable.

So for good science our measures must be both valid and reliable. A valid measure describes only what it says it will and a reliable one is repeatable. These measures then form the basis of an ethogram. An ethogram is a catalogue of the behaviours performed by an animal. In an ideal world we would have a standard ethogram for all the behaviours which a horse can show, so that we have standard units of measurement as they do in physics. The gaits of the horse have been defined in this way (see Leach *et al.* 1984), and some good catalogues relating to specific types of behaviour have been produced like McDonnell and Haviland's ethogram of agonistic behaviour in a bachelor band (1995). Elsewhere we may have less published material which we can use or with which we can agree. We must therefore construct our own ethogram for most studies.

Behaviour can be measured at many different levels and the level we choose should be relevant to the study that we are undertaking. There is no point describing the position of every limb in the horse's body if we are only really interested in which gait it is using. When we have decided on our behavioural unit we need to consider the best way to define it. We could use a straightforward description such as:

Bite - opening and rapid closing of the jaws with the teeth grasping the flesh of another horse. The ears are laid back and lips retracted at this time.

Alternatively we could define the behaviours by means of an algorithm (flow diagram) such as that shown in Figure 1.3.

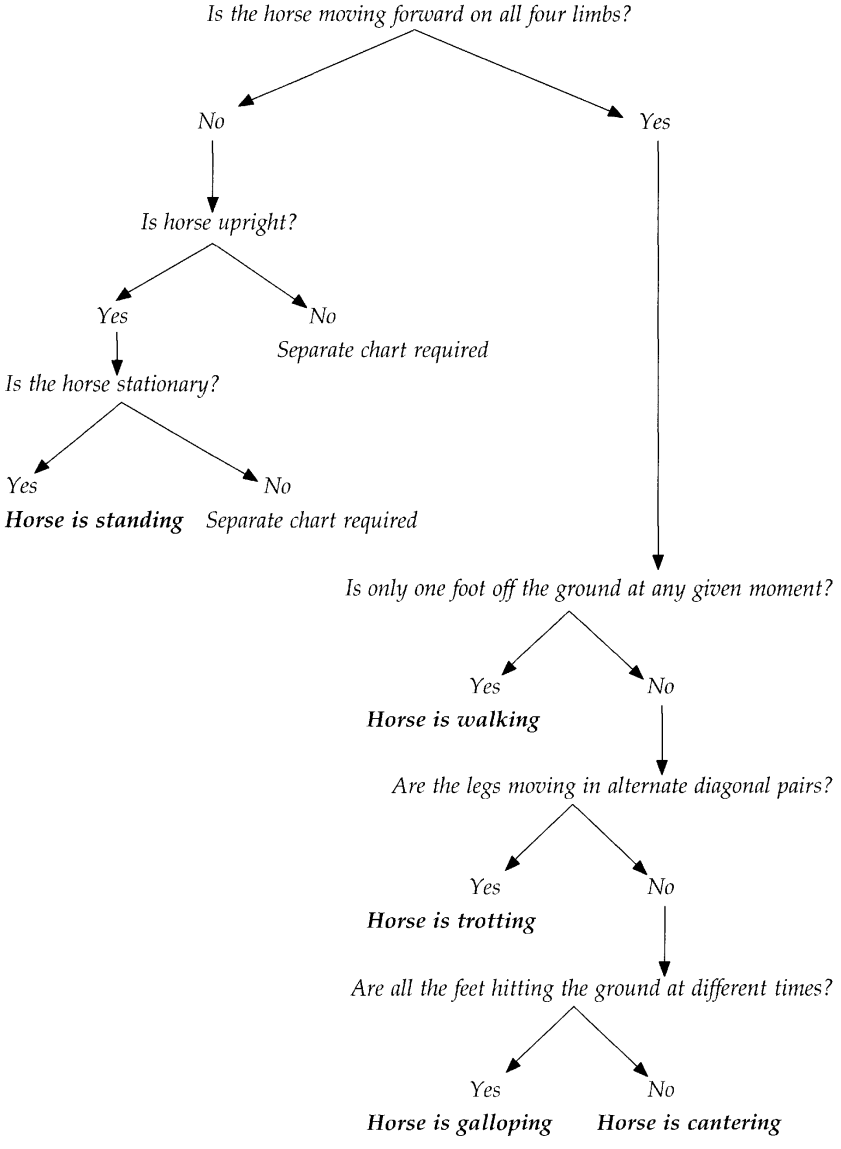


Fig. 1.3 Algorithm for identifying the normal gaits in the horse. Starting at the top of the page answer each question until you come to an explanation given in bold type.

When describing a behaviour in an ethogram, it is best if we keep to a description of what we can see and do not include any reference to function or motivation. The definition of bite given above is much better than 'attacking another horse with its mouth'. The problem with this last example is that we cannot know what is going on in another animal's head and so to depend on these factors means that we are more likely to have an unreliable measure.

Now we have decided on our units, what should we record? Once again we want to make sure that what we record is relevant. Some behaviours are 'events' like a bite, others are 'states' like walking. When we record events we are usually interested in whether or not they are occurring; in which case we will record how often they occur - their frequency. When we consider states, we may be interested in knowing not only whether it has occurred but also how long it went on for (duration). For behaviours which occur several times in short succession, such as mounting attempts by a stallion, we may be interested in the number of bouts of behaviour and number of instances within that bout (local rate) as well as its duration.

As well as scoring the horse's behaviour it may be useful to include some information about where or with whom it occurs, e.g. Barnaby bites Harry. Since there is a lot to record a shorthand is often used. In which case the last example may be recorded as 'B.b.H' for short. It is important to make sure that you can easily understand your shorthand and that it is unambiguous. If Barnaby butts Harry as well, we cannot use the same shorthand.

We now have the measures for the study. All we need to do now is decide how to use them in the study and to do this we must make two more decisions. We must choose our sampling technique and our recording technique.

◇ Sampling involves deciding what to watch.
◇ Recording involves when to write it all down.

Sampling techniques

There are four main types of sampling: ad libitum, focal, scan and behaviour.

(1) **Ad libitum sampling** This means you record as much as you can see at the given time. This is great in the early stages of a project when you want to get a feel of what is going on, or if some of the events that you are interested in are quite rare. The problem with this is that you will inevitably focus on certain types of behaviour (usually the most obvious ones) but can still easily gather a lot of useless information.
(2) **Focal sampling** With this technique you focus on a particular

unit in the field. This might be a specific horse, pair of horses or group of horses. With the additional help of video you may be able to focus on several groups, choosing one for each time you run through the video. This technique is useful if you are interested in what individuals are doing over a given time. An alternative way of doing this is to use the next technique.

(3) **Scan sampling** When you scan sample you observe the behaviour of different individuals in a set order, e.g. A then B then C then A then B etc. It means that you can cover more animals in less time but at the cost of some detail.

(4) **Behaviour sampling** This is used if you are interested in a specific behaviour, rather than the overall activity of an individual or group. You look out for the behaviour of interest and describe its context whenever it occurs in as much detail as required.

Recording techniques

When it comes to doing your observations you can either record behaviour the whole time or give yourself a break. There are therefore two broad categories of recording: continuous and intermittent.

(1) **Continuous recording** means that you can record the time, frequency, duration and latency for a behaviour accurately if necessary. The problem is that it is a lot of work and whilst you are recording you are bound to be missing some other information.

(2) **Intermittent recording** means that the data are recorded at fixed times. At this time we may decide that we are going to only record the behaviour that is happening at that instant (instantaneous recording), or we are going to record what has happened since the last instant (one zero recording). In either case, what we get is a collection of data relating to sample instants. We do not get real measure of duration, frequency, time or latency.

Consider the example in Figure 1.4. With continuous sampling we see six bouts of behaviour and may add the start and stop times of each. With 10 second instantaneous sampling we record three bouts, but can say nothing more. With 15 second instantaneous sampling we record no bouts of behaviour. With one zero sampling at 10 second intervals we appear to have nine bouts of behaviour.

The choice of technique can greatly effect the results obtained. Continuous recording is undoubtedly the most accurate if we need a lot of detail, but entails a lot of work. For comparative studies this

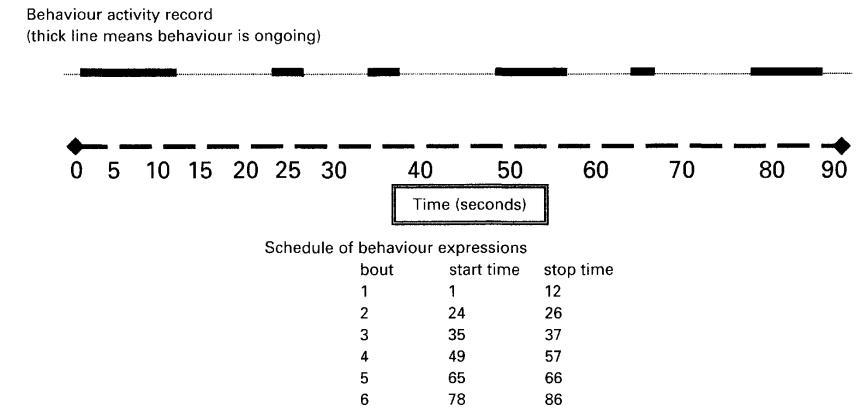


Fig. 1.4 The effect of sampling on the record obtained. See text for details.

extra work may not be necessary because we are interested in differences between groups. As long as we use the same rules for both populations and record enough data, the effect of any error should be the same in all the studies. In this case we do not have exact data but we still have useful data. If we are to use an intermittent recording technique, then we must think carefully about the time intervals that we use. This will depend on how long the behaviours in which we are interested last. If they are very short then short intervals or continuous sampling is necessary, but if the behaviour lasts for longer, then a greater interval is acceptable. If we hope to get an overall view of the activity of the animals in our study with intermittent sampling then we must recognise that this technique will bias the record towards those behaviours which last longer.

Conclusion

In summary, to conduct a good study:

(1) Identify an area of interest
(2) Ask a specific question about this which can be answered by gathering behavioural data
(3) Design your study accordingly
(4) Decide on your measures which should be valid, reliable and relevant
(5) Pilot your study and revise the protocol accordingly
(6) Gather your data
(7) Analyse your data
(8) Assess the implications of your data in the light of its limitations
(9) Draw your conclusions.