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(71) Applicant: THE UNIVERSITY OF SYDNEY [AU/AU];
Sydney, New South Wales 2006 (AU).

(72) Inventor: MCGREEVY, Paul Damien.

(74) Agent: FB RICE; Level 23, 44 Market St, Sydney, New
South Wales 2000 (AU).

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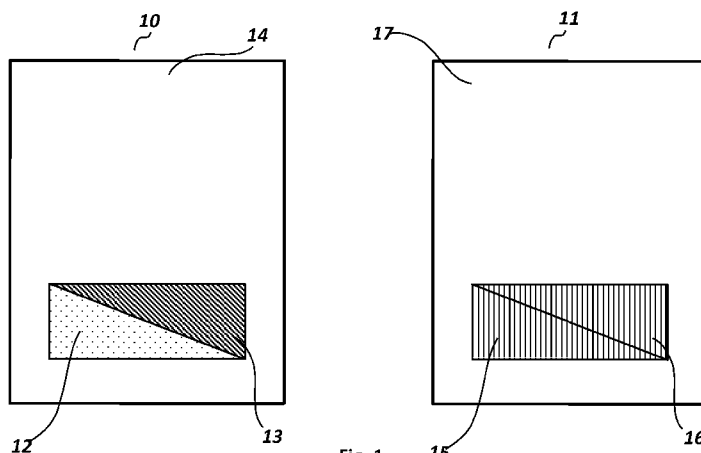


Fig. 1

(57) Abstract: A data record system for recording judgement bias data from an animal is disclosed. Also disclosed is a method of recording judgement bias data in an animal using the data record system of the present disclosure and components thereof, and the use of the recorded judgement bias data in monitoring and management of animal welfare.

DEVICES FOR RECORDING JUDGEMENT BIAS AND USE THEREOF**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] The present application claims priority from Australian Provisional Patent
5 Application No. 2014901171 filed on 1 April 2014, the content of which is incorporated
herein by reference.

FIELD OF THE INVENTION

[0002] The present application relates to the field of animal welfare and management
thereof, and more particularly to devices which measure judgement bias in animals,
10 preferably non-human animals, and the use of said devices in monitoring and/or
management of animal welfare.

BACKGROUND TO THE INVENTION

[0003] Animal welfare (or animal well-being) refers to the physical and emotional
health of an animal. The Office International des Epizooties (OIE), which is the world
15 organisation for animal health, defines animal welfare as meaning how an animal is coping
with the conditions in which it lives. An animal which is enjoying a good state of welfare
is one which is healthy, comfortable, well-nourished, safe, able to express its innate
behaviour, and is not suffering from unpleasant states such as pain, fear, and distress. In
this respect, good animal welfare is not only about ensuring that an animal is not treated
20 cruelly or caused unnecessary pain or suffering, but is about ensuring that an animal's
physical state, mental state and ability to fulfil its natural needs are considered and
attended to.

[0004] In the agricultural sector, maintaining good animal welfare is not only important
from an ethical perspective, but it is also an important financial consideration. This is
25 because poor animal welfare can adversely impact on animal production and reproduction,
thereby affecting output and profitability of an animal production system. Conversely,
animal producers who promote and maintain good animal welfare are more likely to
maximise productively. Poor animal welfare can also result in loss of market access. This
is because consumer awareness of the ethical considerations involved in animal production
30 is growing, and consumers are increasingly looking to make informed choices on the
animal-derived food products they purchase. Such increased awareness of animal welfare
is encouraging consumers to seek animal welfare assurances for the products they purchase

and consider more ethical alternatives. Accordingly, animal producers who promote and maintain good animal welfare are also more likely to increase market share, whereas animal producers who are perceived as producing animals under poor welfare conditions, such as factory farming, are likely to lose market share and/or access.

- 5 [0005] Animal welfare is also a primary consideration in medical research that uses animals e.g., laboratory animals, such as rodents. Medical research and trials performed on non-human animals provide necessary information to predict how new drugs and/or procedures will affect humans, and is generally a prerequisite to achieving approval from regulatory authorities such as the Food and Drug Administration (FDA) in the USA and
- 10 Therapeutic Goods Administration (TGA) in Australia, to market new drugs or procedures for human use. Poor animal welfare in research laboratories can lead to government agencies closing down research facilities and/or lead to research funding being revoked, thereby impeding medical research and the delivery of new and useful drugs to the marketplace. Animal welfare management is therefore a significant economic
- 15 consideration for the health of the pharmaceutical industry. Furthermore, consumer awareness of animal welfare during the testing of therapeutic and cosmetic products is growing, and consumers regularly seek assurances from producers of pharmaceutical and cosmetic products that the products they purchase were produced in an ethical manner. Accordingly, producers of pharmaceutical and/or cosmetic products who promote and
- 20 maintain good animal welfare are also more likely to increase market share and image.

- [0006] Working animals also play an important role in modern society and the welfare of those animals is integral to their ability to perform their working role. For example, society relies heavily on animals such as guide dogs, assistance dogs, animals used in therapy, working dogs/horses, service dogs/horses such as those in the police force,
- 25 customs, AQIS, corrective services and defence force. The welfare of those working animals is important, not only from an ethical standpoint, but for the health of the industries and individuals which rely on the working animals. This is also true for sporting industries which depend animals for their existence e.g., thoroughbred racing, harness racing, hurdles or jumps racing, equestrian events and greyhound racing.

- 30 [0007] Concerns for animal welfare are generally based on the assumption that non-human animals can subjectively experience emotional (affective) states and therefore suffer or experience pleasure. As such, objectively assessing the affective state of an animal or animals is one of the primary concerns of welfare science, with a view to

optimising or improving an animal's quality of life. Studies looking into the welfare of animals have traditionally focused on identifying and characterising negative states tied to stressors such as those causing pain, fear, anxiety and frustration because those states are assumed to reflect poor welfare. As a corollary, it has typically been assumed that good animal welfare results from the absence of those negative states. A major problem arising from this approach to assessing animal welfare is that many negative states observed in non-human animals are adaptive. For example, a stress response may be protective. It has been suggested that assessment of animal welfare should not focus purely on avoiding pain and suffering, but should also place value on positive, pleasurable activities and resources, and it is therefore of growing importance to identify accurate indicators of positive and negative affective state(s) in non-human animals for the assessment of welfare.

[0008] One potential approach to identifying positive and negative affective state(s) in non-human animals is looking at "cognitive biases". Cognitive bias is a term that has been used in the human literature to describe the effects of affective state on a range of cognitive processes, such as information processing and decision-making. It is now being put to similar use in non-human animals, where it has been shown that the cognitive process of judging how to interpret ambiguous signals is under the influence of current affective state. This is called judgement bias. A judgement bias refers to how an animal interprets an ambiguous signal and whether they expect a more positive or negative outcome in response to the ambiguous signal. For example, negative affective states, such as anxiety or stress, typically lead to an expectation of a negative outcome e.g., punishment or a potential threat, and thus a tendency to interpret ambiguous stimuli in a negative manner i.e., a negative bias. This has been referred to in the literature as pessimism or "a glass half-empty perspective". In contrast, positive affective states, such as those that are experienced under good welfare conditions, tend to lead to an expectation of positive outcome in response to ambiguous stimuli. This has been referred to in the literature as optimism. Changes in judgement biases as a proxy of an animal's affective state following changes in environmental conditions has been reported in rats, starlings, sheep, chickens, cats, macaques, pigs, dogs, and honeybees. In each of the non-human species for which judgment bias has been studied to date, negative judgement biases tend to positively correlate with conditions known to induce negative affect, and positive judgement biases positively correlate with conditions known to induce positive affect.

[0009] Whilst devices and methods for measuring judgement bias to assess the valence of an animal's affective state have been proposed in the art, those that currently exist are

either time-consuming to operate thereby producing delayed results e.g., they require video recordal and subsequent analysis of animal interactions with a device, and/or they are expensive to produce and/or operate e.g., require a technician to observe animal behaviour in real time or they rely on expensive electronic components to record behavioural data.

5 Accordingly, the devices and methods of the prior art are not well-suited for use in a commercial environment where it is generally necessary to assess large numbers of animals. Nor are the devices of the prior art cost-effective to operate or manufacture on a commercial scale. Furthermore, many of the devices of the prior art are not well-suited to being left unattended with non-human animals for an extended period of time.

10 [0010] Other methods for objectively measuring animal welfare which rely on physiological data are invasive i.e., they rely on removal of blood, saliva or urine samples for physiological analysis, and are therefore contraindicate because they themselves cause animal distress. Such methods are also time-consuming, expensive and produce delayed result.

15 [0011] In view of the contribution that animals play in society and the importance of animal welfare to the economic health of those industries which rely on animals, there is a need for improved non-invasive devices and methods for assessing welfare of animals.

SUMMARY OF THE INVENTION

[0012] In work leading up to the present invention, the inventor sought to provide
20 devices and/or systems for determining judgement bias in a non-human animal and uses thereof i.e., for determining judgement bias(es) in non-human animals. This was based on a recognition by the inventor that judgement bias could be used as an objective measure of a non-human animal's affective state, and that data on judgement bias(es) could be used to monitor and manage the welfare of non-human animals, such as in commercial
25 environments. Accordingly, the inventors sought to provide an improved devices and/or systems for determining judgement bias in a non-human animal which overcomes one or more of the deficiencies of the prior art devices.

[0013] In doing so, the inventor hypothesized that a non-electronic device and/or system which is configured to record data on judgement bias based on direct interaction of
30 a non-human animal with the device in the absence of electronic data recordal means, such as video recorder system or photointerrupter, would be more cost-effective to manufacture compared to devices and/or systems of the prior art which rely on electronic data recordal

means. Accordingly, the inventor sought to provide non-electronic devices and/or systems configured to retain a physical, detectable legacy of an animal's interaction therewith such that the devices and systems are capable of recording an animal's judgement bias in the absence of electronic recordal means. The inventor reasoned that such a non-electronic device and/or system would be inexpensive to manufacture and would therefore be suited for monitoring and management of animal welfare in a commercial environment where large numbers of devices or systems may be required to accommodate large numbers of animals.

[0014] The inventor also sought to provide a device and/or system for determining judgement bias in a non-human animals which could be left with unattended animals i.e., a device and/or system which does not require a human operator or observer to record judgement bias data. This was based on the recognition by the inventor that a device and/or system which requires operation by a human technician, or which requires observation, supervision and recordal of judgement bias data by a human operator in real-time, is expensive to operate and can be stressful to the animal being assessed. The inventor therefore reasoned that a non-electronic device and/or system which is configured to record judgement bias data in the absence of a human operator or observer could be left with unattended animals and would therefore be less expensive to operate, as well as being less invasive and stressful to non-human animals in use.

[0015] The inventor also sought to provide a device and/or system for determining judgement bias in a non-human animals which facilitated timely recordal and analysis of judgement bias data. This was based on the recognition by the inventor that a system which relies on video recordal of animal interaction(s) with a device and subsequent analysis of recorded behaviour is time-consuming and produces a delayed assessment of an animal's affective state. The inventor recognised that whilst such devices and/or systems may be suitable for academic research purposes, they would not be suitable for implementation in a commercial production or research facility. The inventor therefore reasoned that a non-electronic device which is configured to record data on judgement bias based on direct interaction of a non-human animal with the device in the absence of a video recorder system would be more efficient and cost-effective for measuring judgement bias, and therefore more-readily taken up by industry.

[0016] Based on the assumption that non-human animals experience affective states in much the same way as humans and display similar cognitive biases in their judgement of

ambiguous stimuli when experiencing different background emotional states, the inventor also hypothesized that a device and/or system which is useful for recording judgement bias in a non-human animal may also have utility for recording judgement bias data from, and monitoring welfare of, preverbal human infants and/or humans adult suffering from a cognitive impairment e.g., dementia. The inventor reasoned that the device and/or system which is capable of recording judgement bias data in the absence of a human operator and/or observer and without the assistance of electronic componentry, such as a video recorder, could be left unattended with preverbal children and/or adults suffering cognitive impairment and therefore be used to safely monitor the affective state thereof. The inventor also reasoned that such a device and/or system would be particularly useful for monitoring the affective state in patients suffering from dementia where the incidence of depression has been shown to be higher than that observed in non-demented subjects.

[0017] In one example, the present invention provides a data recordal system for recording judgement bias data from an animal, wherein the data recordal system comprises a training apparatus and a probe apparatus, wherein:

- (a) the training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are distinct from one another, wherein;
 - (i) the first material comprises a substance which is attractive to the animal and the second material does not comprise the substance which is attractive to the animal;
 - (ii) the first and second materials are each configured to record a change in visual appearance thereof following physical contact by the animal therewith; and
 - (iii) the first and second materials are in a spatial relationship to one another;
- (b) the probe apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are each distinct from the first and second materials of the training apparatus, wherein:
 - (i) at least the first material of the probe apparatus does not comprise a substance which is attractive to the animal;
 - (ii) the first and second materials of the probe apparatus are each configured to record a change in visual appearance thereof following physical contact by an animal therewith; and

- (iii) the first and second materials of the probe apparatus are in a spatial relationship which mimics the spatial relationship of the first and second materials of the training apparatus.

- [0018] Judgement bias shall be understood to be a form of “cognitive bias”, which is a term used in the literature to describe the effects of affective state on a range of cognitive processes such as information processing and decision-making. Accordingly, as used herein, the term “judgement bias” shall be taken to mean the cognitive process of judging how to interpret ambiguous signals under the influence of an affective state e.g., whether to expect a more positive or negative outcome in response to an ambiguous stimulus.
- [0019] In one example, the animal is a non-human animal. For example, the non-human animal may be selected from a laboratory animal, a livestock species, a companion animal, a working animal, and a sporting animal. The non-human animal may be a non-human mammal, an avian animal or an aquatic animal. In one example, the non-human animal is a laboratory animal selected from a rodent, a rabbit, a non-human primate, a dog, a cat and a pig. In another example, the non-human animal is a livestock species selected from cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and alpaca. In another example, the non-human animal is a companion animal selected from a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and a rabbit. In another example, the non-human animal is a working animal selected from a horse, a dog, a mule, a donkey, a camel, oxen and a pig. In another example, the non-human animal is a sporting animal selected from a horse and a dog.

- [0020] In another example, the animal is a pre-verbal human. For example, the pre-verbal human may be an infant such as a human infant aged between 0 and 36 months which is not yet able to communicate verbally.
- [0021] In yet another example, the animal is an adult human suffering from a cognitive impairment, such as dementia.

[0022] Preferably, the data recordal system is a non-electronic data recordal system.

- [0023] As used herein, the term “non-electronic” shall be construed to mean that the data recordal system for recording judgement bias data does not comprise any electronic componentry.

[0024] In one example, the first and second materials of the probe apparatus are not distinct from one another.

[0025] In one example, the first and second materials of the probe apparatus do not comprise the substance of the first material of the training apparatus which is attractive to the animal. In another example, the first and second materials of the probe apparatus do not comprise any substance which is attractive to the animal.

[0026] In one example, the first and second materials of the training apparatus and the first and second materials of the probe apparatus each have a surface area configured to be contacted by the animal.

[0027] In one example, the one or more of the material(s) of the training apparatus and/or probe apparatus is/are configured to record a non-reversible change in visual appearance thereof following physical contact by the animal therewith, such as by scratching, licking, ingesting, biting and/or rubbing a surface area of the one or more material(s). For example, a non-reversible change in visual appearance of the one or more materials is selected from a change in shape, texture and/or colour thereof. Preferably, the first and/or second material(s) of the training apparatus and/or probe apparatus is/are configured such that the degree of non-reversible change in visual appearance thereof recorded by the material(s) is correlated with the degree of physical contact by the animal therewith.

[0028] For example, the one or more material(s) of the training apparatus and/or probe apparatus is/are configured to record a change in visual appearance thereof which is detectable by one or more of colorimetry, spectrophotometry, pattern recognition software and/or three dimensional (3-D) surface profiling software.

[0029] In one example, one or more of the first and second materials of the training apparatus and/or probe apparatus is ingestible by the animal.

[0030] For example, the material which is ingestible to the animal may be configured to dissolve in the presence of a water-based solvent e.g., saliva. A suitable material configured to dissolve in the presence of a water-based solvent may be a dissolvable matrix comprising gelatine and/or agar.

[0031] Alternatively, or in addition, the material which is ingestible to the animal may be configured to be friable. For example, a suitably friable material for use with the

present invention may be configured to lose mass following physical contact by an animal. In a preferred example, the friable material may comprise feedstock of an animal feed.

[0032] In one example, the substance which is attractive to the animal is impregnated in first material of the training apparatus. Alternatively, or in addition, the substance which is attractive to the animal is coated on, or forms a layer of, the first material of the training apparatus.

[0033] In one example, the substance which is attractive to the animal has a taste which is attractive to the animal. For example, a substance which has an attractive taste may be a sugar-based material e.g., sucrose, and/or a sugar substitute and/or salt-based material e.g., a salt/mineral lick. Alternatively, or in addition, the substance which is attractive to the animal has a scent which is attractive to the animal.

[0034] In another example, the second material of the training apparatus which does not comprise the substance which is attractive to the animal comprises a substance which is aversive to the animal. For example, the substance which is aversive to the animal may have a taste and/or scent which is unpleasant to the animal e.g., such as acetic acid, a taste-aversive agent (e.g., denatonium benzoate) or a pungent agent. Alternatively, or in addition, the substance which is aversive to the animal may cause discomfort to the animal e.g., chilli or pepper. The substance which is aversive to the animal may be impregnated in the second material of the training apparatus. Alternatively, or in addition, the substance which is aversive to the animal is coated on, or forms a layer of, the second material of the training apparatus.

[0035] The first and second materials of the training apparatus may be visually distinct from each other. The first and second materials of the probe apparatus may be visually distinct from the first and second materials of the training apparatus. However, other means to distinguish between the materials may be used.

[0036] In one example, the first and second materials of the training apparatus are visually distinct from one another by virtue of the first material being of a first colour and the second material being of a second colour, the second colour being different from the first colour. The first and second materials of the probe apparatus may both have a third colour, the third colour being different from the first and second colours. Alternatively, the first material of the probe apparatus may have a third colour and the second material of the

probe apparatus may have a fourth colour, the third and fourth colours each being different from the first and second colours.

[0037] In one example, the first and second materials of the training apparatus are distinct from one another by virtue of a visually detectable signal emitted or reflected therefrom. Preferably, the first and second materials of the probe apparatus are each distinct from the first and second materials of the training apparatus by virtue of a visually detectable signal emitted or reflected therefrom. Exemplary visually detectable signals emitted or reflected from the first and second materials comprise light having a wavelength in a spectrum which is visible to the animal e.g., such as light having a wavelength in a range from about 380nm to about 750nm. Preferably the light having a wavelength in a spectrum which is visible to the animal is visible to the animal as colour.

[0038] Alternatively, or in addition, the visually detectable signals emitted or reflected from the first and second materials of the training apparatus and the probe apparatus comprise a colour or tone which is visibly distinct to the animal.

[0039] In another example, the first and second materials of the training apparatus are distinct from one another by virtue of having textures which are distinct to the animal. Preferably, the first and second materials of the probe apparatus have a texture which is distinct from the textures of the first and second materials of the training apparatus. For example, materials which are distinct from one another by virtue of texture may be distinguished visually. Alternatively, or in addition, materials which are distinct from one another by virtue of texture may be distinguished by touch.

[0040] In yet another example, the first and second materials of the training apparatus are distinct from one another by virtue of shape. Preferably, the first and second materials of the probe apparatus have a shape which is distinct from the shapes of the first and second materials of the training apparatus. For example, materials which are distinct from one another by virtue of shape may be distinguished visually. Alternatively, or in addition, materials which are distinct from one another by virtue of shape may be distinguished by touch.

[0041] In certain examples, the spatial relationship of the first and second materials of the training apparatus is sufficient to condition the animal to associate a corresponding spatial relationship between the region comprising the substance which is attractive to the animal and the region which does not comprise the substance which is attractive to the

animal. In one example, the first and second materials of the training apparatus are adjacent. In one example, the first and second materials of the training apparatus are juxtaposed. In one example, the first and second materials of the training apparatus are overlapping. In one example, the first and second materials of the training apparatus are concentric. Preferably, the spatial arrangement of the first and second materials of the probe apparatus is substantially identical to the spatial arrangement of the first and second materials of the training apparatus.

[0042] In certain examples, the first and second regions of the training apparatus are integral with one another. Alternatively, or in addition, the first and second regions of the probe apparatus are integral with one another.

[0043] In one example, the training apparatus and probe apparatus each comprise a physical support. For example, the first and second materials may be adhered to the physical support. Alternatively, the first and second materials may be integral with the physical support.

[0044] It is to be understood that the physical support may take any shape or form which provides a surface area suitable for an animal to physically interact therewith. In a preferred example, the physical support has a substantially planar form. For example, the physical support may be a card or sheet.

[0045] An exemplary physical support is formed of a paper-based material. In another example, the physical support is formed of a plastic. In another example, the physical support is formed of a metal. In another example, the physical support is formed of a timber. In yet another example, the physical support is formed of a composite material.

[0046] It is to be understood that the data recordal system of the present invention may be configured to record judgement bias data from any animal capable of physically interacting with the training apparatus and probe apparatus thereof. For example, the animal may be a non-human animal, such as a non-human mammal, aquatic animal or avian animal. Alternatively, the animal may be a human, such as a preverbal infant or an adult suffering from dementia.

[0047] In one example, the non-human animal for which the data recordal system is configured for use may be a laboratory animal, such as a rodent, a rabbit, a non-human primate, a dog, a cat and/or a pig. In another example, the non-human animals for which

the data recordal system is configured for use is a livestock species, such as cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and/or alpaca. In another example, the non-human animals for which the data recordal system is configured for use is a companion animal, such as a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and/or a rabbit. In another example, the non-human animals for which the data recordal system is configured for use is a working animal, such as a horse, a dog, a mule, a donkey, a camel, oxen and/or a pig. In another example, the non-human animals for which the data recordal system is configured for use is a sporting animal, such as a horse and/or a dog.

[0048] It also follows from the foregoing that the present invention is directed to the use of a data recordal system according to any example hereof to record judgement bias data from an animal.

[0049] More specifically, in one example, the present invention provides a method of recording judgement bias in an animal comprising:

- (i) exposing the animal to a training apparatus of the data recordal system as described according to any embodiment or example hereof for a period of time sufficient for the animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not comprise the attractive substance;
- (ii) exposing the animal which has been conditioned at (i) to a probe apparatus of the data recordal system as described according to any embodiment or example hereof for a period of time sufficient for the animal to physically interact with one or both of the first and second materials of the probe apparatus to thereby record data on judgement bias.

[0050] In certain examples, the method of the present invention further comprising obtaining or providing the data recordal system as described according to any embodiment or example hereof.

[0051] Exemplary physical interaction(s) with the first and/or second material(s) of the training apparatus and/or probe apparatus by the animal is/are selected from scratching, licking, ingesting, biting and/or rubbing one or more surface areas of the material(s). Preferably, evidence of the physical interaction(s) by the animal is in the form of a change in visual appearance of the first and/or second material(s) of the training apparatus and/or

probe apparatus respectively. For example, a change in visual appearance of the first and/or second material(s) may be a change in one or more of a colour, texture and/or shape thereof.

5 [0052] Evidence of an animal having physically interacted with one or more of the first and second materials of the probe apparatus provides data on judgement bias.

[0053] In one example, the method of the present invention further comprises detecting change(s) in the visual appearance of the first and second materials of the training apparatus following exposure of the animal thereto to determine whether or not the animal is conditioned. Example means for detecting change(s) in the visual appearance of the first
10 and second materials of the training apparatus include colorimetry, spectrophotometry, pattern recognition software and three dimensional (3-D) surface profiling software.

[0054] In one example, the animal exposed to the training apparatus is conditioned when the animal associates a likelihood of a positive outcome with interacting physically with the region of the training apparatus comprising the material comprising the attractive
15 substance and associates a likelihood of neutral or negative outcome with interacting physically with the region of the training apparatus comprising the material which does not comprise the attractive substance. For example, the animal exposed to the training apparatus is conditioned when the animal selectively interacts physically with the material of the training apparatus comprising the attractive substance. Alternatively, or in addition,
20 the animal exposed to the training apparatus is conditioned when the animal avoids physical interaction with the region of the training apparatus comprising the material which does not comprise the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the animal only interacts physically with the region of the training apparatus comprising the material comprising the attractive
25 substance.

[0055] It is to be understood that the method of the present invention may be performed with any animal capable of physically interacting with the training apparatus and probe apparatus of the data recordal system as described in any example hereof. For example, the animal may be a non-human animal, such as a mammal, aquatic animal or avian animal.
30 Alternatively, the animal may be a human e.g., such as a preverbal infant or an adult suffering from dementia.

[0056] In one example, the method of the present invention may be used to record judgement bias data from a laboratory animal, such as a rodent, a rabbit, a non-human primate, a dog, a cat and/or a pig. In another example, the method of the present invention may be used to record judgement bias data from a livestock species, such as cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and/or alpaca. In another example, the method of the present invention may be used to record judgement bias data from a companion animal, such as a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and/or a rabbit. In yet another example, the method of the present invention may be used to record judgement bias data from a working animal, such as a horse, a dog, a mule, a donkey, a camel, oxen and/or a pig. In yet further example, the method of the present invention may be used to record judgement bias data from a sporting animal, such as a horse and/or a dog.

[0057] In certain examples, the present invention provides a probe apparatus of a data recordal system according to any example hereof. The probe apparatus may be disposable following use to record judgement bias data from an animal. Multiple probe apparatuses according to the present invention may be used with a single training apparatus. The probe apparatus may be a replaceable component of the judgement data recordal system.

[0058] In certain examples, the present invention provides a training apparatus of a data recordal system according to any example hereof. The training apparatus may be disposable following use to condition an animal. Multiple training apparatuses according to the present invention may be used with a single probe apparatus. The training apparatus may be a replaceable component of the judgement data recordal system.

[0059] It also follows from the foregoing that the present invention is directed to the use of the probe apparatus according to any example hereof to record judgement bias data from an animal which has been previously conditioned to a cognate training apparatus according to any example hereof.

[0060] More specifically, in one example, the present invention provides a method of recording judgement bias in an animal, said method comprising:

- (i) exposing the animal to a probe apparatus according to any example hereof for a period of time sufficient for the animal to physically interact with one or both of the first and second materials of the probe apparatus to thereby record data on judgement bias,

wherein the animal has been previously conditioned using a training apparatus according to any example hereof by exposing the animal to the training apparatus for a period of time

sufficient for the animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not
5 comprise the attractive substance.

[0061] In certain examples, the method of the present invention further comprises obtaining or providing the probe apparatus according to any example hereof.

[0062] Exemplary physical interaction(s) with the first and/or second material(s) of the probe apparatus by the animal is/are selected from scratching, licking, ingesting, biting
10 and/or rubbing one or more surface areas of the material(s). Preferably, evidence of the physical interaction(s) by the animal is in the form of a change in visual appearance of the first and/or second material(s) of the probe apparatus. For example, a change in visual appearance of the first and/or second material(s) may be a change in one or more of a colour, texture and/or shape thereof.

15 [0063] Evidence of an animal having physically interacted with one or more of the first and second materials of the probe apparatus provides data on judgement bias.

[0064] In certain examples, the method of the present invention further comprises conditioning the animal prior to exposing the animal to the probe apparatus.

[0065] In certain examples, the method of the present invention further comprises
20 obtaining or providing the training apparatus according to any example hereof.

[0066] Exemplary physical interaction(s) with the first and/or second material(s) of the training apparatus by the animal is/are selected from scratching, licking, ingesting, biting and/or rubbing one or more surface areas of the material(s). Preferably, evidence of the physical interaction(s) by the animal is in the form of a change in visual appearance of the
25 first and/or second material(s) of the training apparatus. For example, a change in visual appearance of the first and/or second material(s) may be a change in one or more of a colour, texture and/or shape thereof.

[0067] In one example, the animal exposed to the training apparatus is conditioned when the animal associates a likelihood of a positive outcome with interacting physically
30 with the region of the training apparatus comprising the material comprising the attractive substance and associates a likelihood of neutral or negative outcome with interacting

physically with the region of the training apparatus comprising the material which does not comprise the attractive substance. For example, the animal exposed to the training apparatus is conditioned when the animal selectively interacts physically with the material of the training apparatus comprising the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the animal avoids physical interaction with the region of the training apparatus comprising the material which does not comprise the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the animal only interacts physically with the region of the training apparatus comprising the material comprising the attractive substance.

[0068] It is to be understood that the method of the present invention may be performed with any animal capable of physically interacting with the training apparatus and probe apparatus of the data recordal system as described in any example hereof. For example, the animal may be a non-human animal, such as a mammal, aquatic animal or avian animal. Alternatively, the animal may be a human, such as a preverbal infant or an adult suffering from dementia.

[0069] In one example, the method of the present invention may be used to record judgement bias data from a laboratory animal, such as a rodent, a rabbit, a non-human primate, a dog, a cat and/or a pig. In another example, the method of the present invention may be used to record judgement bias data from a livestock species, such as cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and/or alpaca. In another example, the method of the present invention may be used to record judgement bias data from a companion animal, such as a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and/or a rabbit. In yet another example, the method of the present invention may be used to record judgement bias data from a working animal, such as a horse, a dog, a mule, a donkey, a camel, oxen and/or a pig. In yet further example, the method of the present invention may be used to record judgement bias data from a sporting animal, such as a horse and/or a dog.

[0070] The present invention is also directed to the use of the data recordal system according to any example hereof to determine an affective state of an animal. The animal may be any animal as hereinbefore described.

[0071] More specifically, in one example, the present invention provides a method of determining an affective state of an animal comprising:

- (i) performing a method of recording judgement bias in an animal according to any example hereof;
- (ii) detecting change(s) in the visual appearance of the first and/or second materials of the probe apparatus to detect evidence of judgement bias; and
- 5 (iii) determining the affective state of the animal based on a degree of change in visual appearance of the first and second materials detected at (ii).

[0072] In one example, detecting change(s) in the visual appearance of the first and/or second materials of the probe apparatus may be performed by colorimetry, spectrophotometry, pattern recognition software and/or three dimensional (3-D) surface
10 profiling software.

[0073] In one example, detecting substantially no change in visual appearance of the second material of the probe apparatus i.e., which does not comprise the attractive substance, is indicative of an animal which is pessimistic.

[0074] As used herein, the term “pessimistic” shall be construed in the present context
15 to mean that the animal is in a negative affective state leading to an expectation of negative outcomes. It will therefore be appreciated that pessimism will lead to a negative bias in the interpretation of ambiguous signals.

[0075] As used herein, the term “optimistic” shall be construed in the present context to mean that the animal is in a positive affective state leading to an expectation of positive
20 outcomes. It will therefore be appreciated that optimism will lead to a positive bias in the interpretation of ambiguous signals

[0076] In one example, detecting change in visual appearance of the first and second material(s) of the probe apparatus is indicative of an animal which is optimistic.

[0077] In certain examples, the method of determining an affective state of an animal of
25 the present invention further comprises comparing a detected level of change in the visual appearance of the first and/or second materials of the probe apparatus to one or more threshold level(s) of change to determine whether the animal is optimistic or pessimistic. For example, a detected level of change in the visual appearance of the first and/or second material(s) which is greater than the respective threshold level(s) for the first and/or second
30 material(s) is indicative of an animal which is optimistic. Conversely, a detected level of change in the visual appearance of the first and second materials which is less than

respective threshold levels for the first and first and/or second material(s) which is less than the respective threshold level(s) for the first and/or second material(s) is indicative of an animal which is pessimistic.

5 [0078] As will be apparent from the preceding description, the affective state of the animal is an objective measure of the animal's welfare. Accordingly, in one example, an animal which is determined to be pessimistic may be determined to suffer from poor welfare relative to a corresponding animal which is determined to be optimistic. It also follows that an animal which is determined to be optimistic may be determined to enjoy better welfare relative to a corresponding animal which is determined to be pessimistic.

10 [0079] In certain examples, the data recordal system according to any example hereof is packaged with instructions for use in a method of recording judgement bias according to any example hereof. Alternatively, or in addition, the data recordal system according to any example hereof is packaged with instructions for use in a method of method of determining an affective state of an animal according to any example hereof.

15 [0080] In certain examples, the probe apparatus according to any example hereof is packaged with instructions for use in a method of recording judgement bias according to any example hereof. Alternatively, or in addition, the probe apparatus according to any example hereof is packaged with instructions for use in a method of method of determining an affective state of an animal according to any example hereof.

20 [0081] In certain examples, the training apparatus according to any example hereof is packaged with instructions for use in a method of recording judgement bias according to any example hereof. Alternatively, or in addition, the training apparatus according to any example hereof is packaged with instructions for use in a method of method of determining an affective state of an animal according to any example hereof.

25 BRIEF DESCRIPTION OF THE DRAWINGS

[0082] The present invention is further described with reference to the following non-limiting drawings.

[0083] Figure 1 shows a plan view of a data recordal system according to an embodiment of the present invention.

30 [0084] Figure 2 shows a plan view of a data recordal system according to another embodiment of the present invention.

[0085] Figure 3 shows a plan view of a training apparatus of the data recordal system of Figure 1 which is indicative of an animal which has reached a conditioned criterion.

[0086] Figure 4a shows a plan view of a probe apparatus of the data recordal system of Figure 1 after being exposed to an animal which has been conditioned with a training apparatus of Figure 1, and wherein the probe apparatus has recorded judgement bias data having a profile which is indicative of the animal being optimistic.

[0087] Figure 4b shows a plan view of a probe apparatus of the data recordal system of Figure 1 after being exposed to an animal which has been conditioned with a training apparatus of Figure 1, and wherein the probe apparatus has recorded judgement bias data having a profile which is indicative of the animal being pessimistic.

DETAILED DESCRIPTION OF THE INVENTION

The data recordal system and components thereof

[0088] In a first example, the present invention provides a data recordal system for recording judgement bias data from an animal, wherein the data recordal system comprising a training apparatus and a probe apparatus, wherein:

- (a) the training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are distinct from one another, wherein;
 - (i) the first material comprises a substance which is attractive to the animal and the second material does not comprise the substance which is attractive to the animal;
 - (ii) the first and second materials are each configured to record a change in visual appearance thereof following physical contact by the animal therewith; and
 - (iii) the first and second materials are in a spatial relationship to one another;
- (b) the probe apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are not distinct from one another but are each distinct from the first and second materials of the training apparatus, wherein:
 - (i) at least the first material of the probe apparatus does not comprise a substance which is attractive to the animal;
 - (ii) the first and second materials of the probe apparatus are each configured to record a change in visual appearance thereof following physical contact by an animal therewith; and

- (iii) the first and second materials of the probe apparatus are in a spatial relationship which mimics the spatial relationship of the first and second materials of the training apparatus.

[0089] In a second example, the present invention provides a probe apparatus for recording judgement bias data from an animal which has been pre-conditioned with a cognate training apparatus, wherein the probe apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are not distinct from one another, and wherein:

- (i) at least the first material of the probe apparatus does not comprise a substance which is attractive to the animal;
- (ii) the first and second materials of the probe apparatus are each configured to record a change in visual appearance thereof following physical contact by an animal therewith; and
- (iii) the first and second materials of the probe apparatus are in a spatial relationship to one another; and

wherein the training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials of the training apparatus are distinct from one another and are each distinct from the first and second materials of the probe apparatus, and wherein:

- (iv) the first material of the training apparatus comprises a substance which is attractive to the animal and the second material of the training apparatus does not comprise the substance which is attractive to the animal;
- (v) the first and second materials of the training apparatus are each configured to record a change in visual appearance thereof following physical contact by the animal therewith;
- (vi) the first and second materials of the training apparatus are in a spatial relationship to one another which mimics the spatial relationship of the first and second materials of the probe apparatus; and
- (vii) the spatial relationship of the first and second regions of the training apparatus is sufficient to condition an animal to associate a corresponding spatial relationship between the material comprising the attractive substance and the material not comprising the substance attractive substance.

[0090] In a third example, the present invention provides a training apparatus for conditioning an animal prior to recording judgement bias data with a probe apparatus

according to the second example, wherein said training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are distinct from one another, wherein;

- (i) the first material comprises a substance which is attractive to the animal and the second material does not comprise the substance which is attractive to the animal;
- (ii) the first and second materials are each configured to record a change in visual appearance thereof following physical contact by the animal therewith; and
- (iii) the first and second materials are in a spatial relationship to one another sufficient to condition an animal to associate a corresponding spatial relationship between the material comprising the attractive substance and the material not comprising the substance attractive substance.

[0091] In one example, the animal is a non-human animal.

[0092] As used herein, the term “non-human animal” shall be taken in its broadest context to include any non-human animal for which it might be useful to record judgement bias data, such as, laboratory animals, a livestock species, companion animals, working animals, and sport animals. The non-human animal may be a non-human mammal, an avian animal or an aquatic animal. In one example, the non-human animal is a laboratory animal selected from a rodent, a rabbit, a non-human primate, a dog, a cat and a pig. In another example, the non-human animal is a livestock species selected from cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and alpaca. In another example, the non-human animal is a companion animal selected from a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and a rabbit. In another example, the non-human animal is a working animal selected from a horse, a dog, a mule, a donkey, a camel, oxen and a pig. In another example, the non-human animal is a sporting animal selected from a horse and a dog.

[0093] Accordingly, it will be understood that the data recordal system, probe apparatus and/or training apparatus may be adapted for use with one or more of the non-human animal described hereinabove.

[0094] In another example, the animal is a human. For example, human may be a pre-verbal human, such as a human infant aged between 0 and 36 months which has not yet able to communicate verbally. In another example, the human is an adult human suffering from a cognitive impairment, such as dementia. A human suffering dementia for which the data recordal system may be useful may have an impaired ability to communicate, such as

in the case of advanced dementia. The human suffering from dementia may suffer from, or have previously suffered from, depression.

[0095] A plan view of the data recordal system according to an embodiment of the present invention is illustrated in Figure 1. As will be apparent, the data recordal system according to the embodiment illustrated in Figure 1 includes a training apparatus 10 and a probe apparatus 11 as separate components. The training apparatus 10 includes a first material 12 and a second material 13 positioned on the surface of a support 14 in a juxtaposed arrangement or spatial relationship. The probe apparatus 11 includes a first material 15 and a second material 16 positioned on the surface of a support 17 in a juxtaposed arrangement or spatial relationship.

[0096] A plan view of the data recordal system according to another embodiment of the present invention is illustrated in Figure 2. The data recordal system according to the embodiment illustrated in Figure 2 includes a training apparatus 20 and a probe apparatus 21 as separate components. The training apparatus 20 includes a first material 22 and a second material 23 positioned on the surface of a support 24 in a concentric arrangement. The probe apparatus 21 includes a first material 25 and a second material 26 positioned on the surface of a support 27 in a concentric arrangement or spatial relationship.

[0097] As will be apparent from the embodiments illustrated in Figures 1 and 2, the spatial relationship and/or arrangement of the first material 15, 25 and second materials 16, 26 of the probe apparatus 11, 21 relative to one another is substantially identical to, or mimics, the spatial relationship and/or arrangement of the first material 12, 22 and the second material 13, 23 of the training apparatus 10, 20 relative to one another. According, whilst the embodiments illustrated in Figures 1 and 2 provide two exemplary arrangements, it is to be understood that any arrangement may be employed e.g., adjacent, juxtaposed, overlapping or concentric, provided that the spatial relationship and/or arrangement of the first material 15, 25 and second material 16, 26 of the probe apparatus 11, 21 is substantially identical to, or mimics, the spatial relationship and/or arrangement of the first material 12, 22 and the second material 13, 23 of the training apparatus 10, 20 relative to one another.

[0098] For convenience, the following description is provided with reference to the embodiment of the data recordal system illustrated in Figure 1 only.

[0099] The first material 12 and second material 13 of the training apparatus 10 will be configured to be distinct from one another and distinct from the first material 15 and second material 16 of the probe apparatus 11, whereas the first material 15 and second material 16 of the probe apparatus 11 will not be distinct from one another. In this way, a non-human for which the data recordal system is to be used will be able to distinguish between the first material 12 and second material 13 of the training apparatus 10 and be able to distinguish the first material 12 and second material 13 of the training apparatus 10 from the first material 15 and second material 16 of the probe apparatus 11. However, the non-human animal should not be able to distinguish between the first material 15 and second material 16 of the probe apparatus 11.

[00100] In one embodiment, an animal will be able to distinguish between the first material 12 and second material 13 of the training apparatus 10, and be able to distinguish the first material 15 and second material 16 of the probe apparatus 11 from the first material 12 and second material 13 of the training apparatus 10, by virtue of the respective materials emitting and/or reflecting light having different wavelengths in a spectrum visible to the non-human animal different. Preferably, the emitted and/or reflected light has a wavelength in a range from about 380nm to about 750nm. More preferably, the animal can distinguish the emitted and/or reflected light as colour and/or tone. Accordingly, an animal with which the data recordal system is to be used may be able to distinguish between the respective materials by virtue of tonal differences or differences in colour. For example, the respective materials may comprise, or be coated with, a substance which emits and/or reflects one or more colour(s) which is/are visible to the animal, such as an ink, food colouring, dye and/or pigment. The one or more colours may be distinguished from one another according to their hue, tint, shade and/or tone.

[00101] In another embodiment, an animal will be able to distinguish between the first material 12 and second material 13 of the training apparatus 10, and be able to distinguish the first material 15 and second material 16 of the probe apparatus 11 from the first material 12 and second material 13 of the training apparatus 10, by virtue of differences in textures of the respective materials which are visually distinguishable. For example, materials which are configured to be distinct may be configured to have a different surface textures, such as a surface texture which is corrugated, hatched, dimpled, smooth, rough, bumpy, grainy, glossy or matte. Materials which are distinct from one another by virtue of texture may be distinguished visually. Alternatively, or in addition, materials which are distinct from one another by virtue of texture may be distinguished by touch

[00102] In yet another embodiment, an animal will be able to distinguish between the first material 12 and second material 13 of the training apparatus 10, and be able to distinguish the first material 15 and second material 16 of the probe apparatus 11 from the first material 12 and second material 13 of the training apparatus 10, by virtue of the
5 respective materials being configured in different two-dimensional (2-D) and/or three-dimensional (3-D) shapes and/or forms. For example, materials which are configured to be distinct may be configured to have a distinct shape and/or form, such as a triangular, circular, elliptical, square, rectangular, pentagonal, hexagonal or other shape. Materials which are distinct from one another by virtue of 2-D or 3-D shape and/or form may be
10 distinguished visually. Alternatively, or in addition, materials which are distinct from one another by virtue of 2-D or 3-D shape and/or form may be distinguished by touch.

[00103] To enable the training apparatus 10 and probe apparatus 11 to record physical interaction events by an animal therewith, the first material 12 and second material 13 of the training apparatus 10, and the first material 15 and second material 16 of the probe
15 apparatus 11, will each be formed of, or comprise, a material which is configured to change in visual appearance e.g., change in shape, texture and/or colour thereof, following physical interaction by the animal therewith e.g., scratching, licking, ingesting, biting and/or rubbing a surface area of the respective material(s). Preferably, the change in visual appearance is a non-reversible change to enable permanent recordal of the physical
20 interaction event and thereby record data on judgement bias. The skilled person will appreciate that the nature and degree of the change in visual appearance of the respective material, if any, will be dependent on the nature and degree of physical interaction(s) by the animal therewith.

[00104] Material(s) configured to change in visual appearance following physical contact
25 by an animal therewith which are suitable for use with the present invention are preferably non-toxic to the animal, and preferably ingestible. The material(s) which is/are configured to change in visual appearance following physical contact by an animal therewith may be fixed to the surface of the support 14 17 by any convenient means known to the skilled person e.g., using a non-toxic adhesive, lamination and/or clips and/or brackets and/or
30 staples and/or nails.

[00105] In one example, the material configured to change in visual appearance following physical contact by an animal therewith is dissolvable in the presence of a water-based solvent, such as saliva. Conveniently, the dissolvable material may be an edible

matrix made from a recognised foodstuff, such as gelatine or agar, which is suitable for ingestion by an animal e.g., as disclosed in WO2004039166 and US20040087467 A1. Alternative suitable materials configured to dissolve in the presence of a water-based solvent will be known to a person of skill in the art. Preferably, the material which

5 dissolves in the presence of a water-based solvent will comprise a pigment, dye and or other colouring agent, such that upon dissolution of the material following physical interaction by the animal therewith e.g., licking, ingesting or mouthing the material, there is a detectable change in at least one colour property at the site of the training apparatus 10 or probe apparatus 11 corresponding to the site of the physical interaction. Conveniently, the change in colour may be detected and/or quantified using, for example, colorimetry, spectrophotometry and/or pattern recognition software.

[00106] In another example, the material configured to change in visual appearance following physical contact by an animal therewith may be a material which is friable. Preferably, the material is sufficiently friable to crumble and/or breakdown following

15 physical contact by an animal therewith e.g., scratching, licking, biting and/or rubbing against the friable material. The friable material may have a hardness which is equivalent to that of a material having a hardness value in the range of 1 to 3 on the Moh's hardness scale. Preferably, the friable material has a hardness which is equivalent to that of a material having a hardness value in the range of 1 to 2 on the Moh's hardness scale. It will

20 be appreciated that the specific material will depend on the species of animal for which the data recordal system is to be used, and may conveniently be an animal foodstuff, or feedstock thereof, known for use with the animal for which the system is to be used. The suitability of a material for use in this embodiment of the invention may be determined using an impact, vibration, shear and/or tumbler test known in the food

25 manufacture/processing arts for assessing friability of foodstuffs. Preferably, the material is sufficiently friable such that, following physical interaction by the animal therewith e.g., scratching, biting, ingesting or rubbing against, there is a detectable change in the surface profile and/or mass of the friable material. Conveniently, the change in surface profile and/or mass of the friable material may be detected and/or quantified using, for example,

30 pattern recognition software and/or three dimensional (3-D) surface profiling software.

[00107] In yet another example, the material configured to change in visual appearance following physical contact by an animal therewith may be formed of, or comprise, a material which is thermochromatic. Thermochromatic materials suitable for use with the invention are known in the art and are commercially available. For example, the

thermochromatic material may be a thermochromatic film, paint or dye e.g., as described in WO2008012709. Accordingly, following physical contact by the animal with the thermochromatic material e.g., scratching, pawing, handling, nosing and/or rubbing against, there will be a detectable change in colour at the site of the training apparatus 10 or probe apparatus 11 corresponding to the site of the physical contact. It will be understood that the surface area of the thermochromatic material which undergoes a change in colour will be correlated with the area of the thermochromatic material contacted by the animal. It will also be understood that the degree of colour change may be correlated with the nature and duration of the physical interaction, and the body temperature of the animal. Conveniently, the change in colour may be detected and/or quantified using, for example, colorimetry and/or pattern recognition software.

[00108] In yet another example, the material configured to change in visual appearance following physical contact by an animal therewith may be a non-toxic latex ink or similar scratch off material known in the art, such as for use in instant lottery tickets. Following physical contact by the animal with the latex ink or similar scratch off material e.g., by scratching, biting, and/or rubbing against, there will be a detectable change in the colour and/or pattern at the site of the training apparatus 10 or probe apparatus 11 corresponding to the site of the physical contact. In this way, the training apparatus 10 and probe apparatus 11 enable permanent recordal of the physical contact events by the animal therewith. Conveniently, the change in colour may be detected and/or quantified using, for example, colorimetry and/or pattern recognition software.

[00109] In each embodiment of the present invention, one of the first material 12 and the second material 13 of the training apparatus 10 will comprise a substance which is attractive to an animal for which the data recordal system is to be used e.g., a substance which has an attractive taste and/or scent. For example, the substance which is attractive to the animal may be a sugar-based material e.g., sucrose, and/or a sugar substitute and/or salt-based material e.g., a salt/mineral lick, and/or a pheromone or other scenting agent. Such substances will be known in the art and may vary widely depending on the animal for which the data recordal system is to be used. The attractive substance may be impregnated in, or coated onto, the first material 12 or the second material 13. The other material which does not comprise the attractive substance will comprise a substance which is aversive to the animal e.g., a substance which has a taste and/or scent which is unpleasant to the animal. For example, a suitable aversive substance for use in the present invention may be acetic acid, a taste-aversive agent (e.g., denatonium benzoate), a pungent agent, or a prey scent.

In this way, an animal to which the training apparatus 10 is exposed will be rewarded by physically interacting with e.g., scratching, licking, nosing, pawing, mouthing, ingesting, biting and/or rubbing against, one of the first and second materials comprising the attractive substance and thereby learn to associate a positive outcome with that distinct material. On the other hand, an animal to which the training apparatus 10 is exposed will receive a non-reward or negative outcome following a physical interaction with e.g., scratching, licking, nosing, pawing, mouthing, ingesting, biting and/or rubbing against, the other material comprising the aversive substance, and thereby learn to associate a negative outcome with that distinct material. By physically interacting with both the first material 12 and second material 13 of the training apparatus 10 over a period of time, an animal is able to learn a positive association with one of the first material 12 and second material 13 and learn a negative association with the other. A skilled artisan will recognise that the time it takes to train an animal to learn an association between the first material 12 and second material 13 and a positive or negative outcome will vary according to the species of animal and/or the stage of cognitive development or impairment.

[00110] Conversely, neither of the first material 15 nor the second material 16 of the probe apparatus 11 will comprise the substance which is attractive to the animal or the substance which is aversive to the animal as described hereinabove with respect to the training apparatus 10. Accordingly, an animal which physically interacts with the first material 15 and/or the second material 16 of the probe apparatus 11 e.g., scratching, licking, nosing, pawing, mouthing, ingesting, biting and/or rubbing against either material, will receive neither a reward nor an aversive outcome. Nor will the animal be able to visually distinguish between the first material 15 and the second material 16 of the probe apparatus 11. In this respect, the probe apparatus 11 represents an “ambiguous stimulus”.

[00111] It will also be appreciated that the size and dimensions of the first material 12 and second material 13 of the training apparatus 10, and the first material 15 and second material 16 of the probe apparatus 11, may vary depending on the animal for which the data recordal system is to be used, and provided that respective first and second materials present a sufficient surface area with which the animal may physically interact.

[00112] It will be understood that the supports 14, 17 which fulfil the function of providing a structural support for the respective first and second materials may be formed of any suitable material known to a person of skill in the art that fulfils that purpose e.g., plastic, metal, timber, card and/or composite material. It will also be appreciated that the

supports 14, 17 may be configured to be any shape and/or size depending on the animal for which the data recordal system is to be used. In one example, the supports 14, 17 are substantially planar, such as a sheet or card. In another example, the supports 14, 17 are semi-spherical.

- 5 [00113] The supports 14, 17 may also comprise means for attaching or mounting the training apparatus 10 or probe apparatus 11 respectively to a surface, such as a wall of the animal's housing or cage. For example, a data recordal system of the invention which is configured for use with a rodent will be small enough to fit in a rodent cage and may be adapted for mounting to the side of a cage. In another example, a data recordal system of
10 the invention which is configured for use with a horse will be large enough to accommodate interaction with the animal nose and/or lips and adapted for mounting to the side of a stable wall.

[00114] The present invention also provides a probe apparatus 11 of a data recordal system according to any example hereof.

- 15 [00115] The present invention also provides a training apparatus 10 of a data recordal system according to any example hereof.

Use of the data recordal system and/or components thereof

- [00116] The present invention also provides for the use of a data recordal system of the present invention as described according to any embodiment or example hereof to record
20 data on judgement bias in an animal.

[00117] In one example, the present invention provides a method of recording judgement bias in an animal comprising:

- (i) exposing the animal to a training apparatus of the data recordal system as as described according to any embodiment or example hereof for a period of time sufficient for the
25 animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not comprise the attractive substance;
- 30 (ii) exposing the animal which has been conditioned at (i) to a probe apparatus of the data recordal system as described according to any embodiment or example hereof for a period of time sufficient for the animal to physically interact with one or both of the

first and second materials of the probe apparatus to thereby record data on judgement bias.

[00118] In one example, the method of the present invention further comprises obtaining or providing the data recordal system as described according to any embodiment or
5 example hereof.

[00119] The animal may be a non-human animal as described in any example or embodiment hereof. Alternatively, the animal may be a human animal as described in any example or embodiment hereof.

[00120] Exemplary physical interaction(s) with the first and/or second material(s) of the
10 training apparatus and/or probe apparatus by the animal is/are selected from scratching, licking, nosing, ingesting, biting and/or rubbing one or more surface areas of the material(s). Preferably, evidence of the physical interaction(s) by the animal is in the form of a change in visual appearance of the first and/or second material(s) of the training apparatus and/or probe apparatus respectively. For example, a change in visual appearance
15 of the first and/or second material(s) may be a change in one or more of a colour, texture and/or shape thereof as described in the preceding description.

[00121] Evidence of an animal having physically interacted with one or more of the first and second materials of the probe apparatus provides data on judgement bias.

[00122] Change, if any, in the visual appearance of the first and/or second material(s) of
20 the training apparatus and/or probe apparatus following exposure of the animal thereto to may be detected by an appropriate means, such as by colorimetry, spectrophotometry, pattern recognition software and/or three dimensional (3-D) surface profiling software. Accordingly, detection may be quantitative or semi-quantitative.

[00123] In one example, the animal exposed to the training apparatus is conditioned
25 when the animal has learned to associate a likelihood of a positive outcome with interacting physically with the region of the training apparatus comprising the material comprising the attractive substance and learned to associate a likelihood of neutral or negative outcome with interacting physically with the region of the training apparatus comprising the material which does not comprise the attractive substance. For example,
30 the animal exposed to the training apparatus is conditioned when the animal selectively interacts physically with the material of the training apparatus comprising the attractive

substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the non-human animal avoids physical interaction with the region of the training apparatus comprising the material which does not comprise the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is
5 conditioned when the animal only interacts physically with the region of the training apparatus comprising the material comprising the attractive substance.

[00124] It also follows from the foregoing that the present invention is directed to the use of the probe apparatus according to any example hereof to record judgement bias data from an animal which has been previously conditioned to a cognate training apparatus according
10 to any example hereof.

[00125] In one example, the present invention provides a method of recording judgement bias in an animal, said method comprising:

(i) exposing the animal to a probe apparatus according to any example hereof for a period of time sufficient for the animal to physically interact with one or both of the first and
15 second materials of the probe apparatus to thereby record data on judgement bias, wherein the animal has been previously conditioned using a training apparatus according to any example hereof by exposing the animal to the training apparatus for a period of time sufficient for the animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship
20 between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not comprise the attractive substance.

[00126] Exemplary physical interaction(s) with the first and/or second material(s) of the probe apparatus by the animal is/are selected from scratching, licking, nosing, ingesting,
25 biting and/or rubbing one or more surface areas of the material(s). Preferably, evidence of the physical interaction(s) by the animal is in the form of a change in visual appearance of the first and/or second material(s) of the probe apparatus. For example, a change in visual appearance of the first and/or second material(s) may be a change in one or more of a colour, texture and/or shape thereof.

30 [00127] Evidence of a non-human animal having physically interacted with one or more of the first and second materials of the probe apparatus provides data on judgement bias.

[00128] In one example, the animal exposed to the training apparatus is conditioned when the animal associates a likelihood of a positive outcome with interacting physically with the region of the training apparatus comprising the material comprising the attractive substance and associates a likelihood of neutral or negative outcome with interacting physically with the region of the training apparatus comprising the material which does not comprise the attractive substance. For example, the animal exposed to the training apparatus is conditioned when the animal selectively interacts physically with the material of the training apparatus comprising the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the animal avoids physical interaction with the region of the training apparatus comprising the material which does not comprise the attractive substance. Alternatively, or in addition, the animal exposed to the training apparatus is conditioned when the animal only interacts physically with the region of the training apparatus comprising the material comprising the attractive substance.

[00129] It is to be understood that the methods of the present invention may be performed with any animal capable of physically interacting with the training apparatus and/or probe apparatus of the data recordal system as described in any example hereof. For example, the animal may be a non-human animal as described in any example hereof, such as a mammal, aquatic animal or avian animal. Alternatively, the animal may be a human as described in any example hereof, such as a preverbal infant or an adult suffering from dementia.

[00130] In one example, the method of the present invention may be used to record judgement bias data from a laboratory animal, such as a rodent, a rabbit, a non-human primate, a dog, a cat and/or a pig. In another example, the method of the present invention may be used to record judgement bias data from a livestock species, such as cattle, pigs, sheep, horse, poultry, goats, deer, donkey, and/or alpaca. In another example, the method of the present invention may be used to record judgement bias data from a companion animal, such as a cat, a dog, a fish, a reptile, a bird, a horse, a rodent and/or a rabbit. In yet another example, the method of the present invention may be used to record judgement bias data from a working animal, such as a horse, a dog, a mule, a donkey, a camel, oxen and/or a pig. In yet further example, the method of the present invention may be used to record judgement bias data from a sporting animal, such as a horse and/or a dog.

[00131] The present invention is also directed to the use of the data recordal system according to any example hereof to determine an affective state of an animal.

[00132] For example, the present invention provides a method of determining an affective state of an animal comprising:

- 5 (i) performing a method of recording judgement bias in an animal according to any example hereof;
- (ii) detecting change(s) in the visual appearance of the first and/or second materials of the probe apparatus to detect evidence of judgement bias; and
- (iii) determining the affective state of the animal based on a degree of change in visual
10 appearance of the first and second materials detected at (ii).

[00133] As described in the preceding description, the detection of change(s) in the visual appearance of the first and/or second materials of the probe apparatus may be performed by colorimetry, spectrophotometry, pattern recognition software and/or three dimensional (3-D) surface profiling software.

- 15 [00134] The detection of substantially no change in visual appearance of the second material of the probe apparatus i.e., which does not comprise the attractive substance, is indicative of an animal which is pessimistic. Conversely, detection of change in visual appearance of the first and second material(s) of the probe apparatus is indicative of an animal which is optimistic.

- 20 [00135] In certain examples, the method of determining an affective state of a non-human animal of the present invention further comprises comparing a detected level of change in the visual appearance of the first and/or second materials of the probe apparatus to one or more threshold level(s) of change to determine whether the animal is optimistic or pessimistic. For example, a detected level of change in the visual appearance of the first
25 and/or second material(s) which is greater than respective threshold levels for the first and/or second material(s) is indicative of an animal which is optimistic. Conversely, a detected level of change in the visual appearance of the first and/or second material(s) which is less than respective threshold levels for the first and/or second material(s) is indicative of an animal which is pessimistic. .

- 30 [00136] As will be apparent from the preceding description, the affective state of an animal is an objective measure of that animal's state of welfare. Accordingly, in one example, an animal which is determined to be pessimistic may be determined to suffer

from poor welfare relative to a corresponding animal which is determined to be optimistic. It also follows that an animal which is determined to be optimistic may be determined to enjoy better welfare relative to a corresponding animal which is determined to be pessimistic.

5 Kits comprising the data recordal system or components thereof

[00137] The present invention also provides kits comprising the data recordal system as described in any example or embodiment hereof packaged with instructions for use in a method of recording judgement bias as described in any example or embodiment hereof. The kit may further comprise instructions for use in a method for determining an affective

10 state of an animal according to any example hereof

[00138] In another example, the present invention also provides kits comprising the training apparatus or the probe apparatus as described in any example or embodiment hereof as separate components packaged with instructions for use in a method of recording judgement bias as described in any example or embodiment hereof. The kit may further

15 comprise instructions for use in a method for determining an affective state of an animal according to any example hereof.

EXAMPLE 1

A data recordal system and use thereof with a rodent

[00139] The present invention is now described with reference to an exemplary
5 embodiment of the data recordal system with reference to Figure 1 which is suitable for
determining judgement bias in a rodent, such as in a laboratory environment.

[00140] The data recordal system according to the embodiment illustrated in Figure 1
includes a training apparatus 10 and a probe apparatus 11 as separate components. The
training apparatus 10 and a probe apparatus 11 each comprise a support 14 17, which is
10 conveniently a planar sheet or card made of a non-toxic plastic suitable for use with
rodents in a laboratory environment. The supports 14 17 are suitably rigid to facilitate
mounting of the training apparatus 10 and probe apparatus 11 to a wall of the enclosure in
which the rodent is housed i.e., a cage. The training apparatus 10 and probe apparatus 11
are each of a size suitable for installation in a rodent cage, and the proportion of the
15 corresponding components will adapted appropriately.

[00141] The training apparatus 10 includes a first material 12 and a second material 13
positioned on the surface of the support 14 in a juxtaposed arrangement. The probe
apparatus 11 also includes a first material 15 and a second material 16 positioned on the
surface of a support 17 in a juxtaposed arrangement or spatial relationship. As will be
20 apparent from the embodiment illustrated in Figure 1, the spatial arrangement of the first
material 15 and second material 16 of the probe apparatus 11 relative to one another is
substantially identical to the spatial arrangement of the first material 12 and the second
material 13 of the training apparatus 10 relative to one another.

[00142] The first material 12 and second material 13 of the training apparatus 10, and the
25 first material 14 and second material 15 of the probe apparatus, will each be edible films
formed of a dissolvable gelatine-based matrix, such as described in WO2004039166. The
edible films may be applied directly to the surface of the respective supports 14 17 in a
liquid or semi-liquid phase during manufacture and allowed to set on the surface of the
support as a film. The edible film corresponding to the first material 12 shall be
30 impregnated with a sweetener e.g., sucrose or sucralose, to thereby give the film a taste
which is attractive to a rodent to which the apparatus is to be exposed, and the edible film
corresponding to the second material 13 is impregnated with an aversive agent e.g.,
denatonium or sucrose octaacetate, to thereby give this film a taste which is unpleasant to a

rodent to which the apparatus is to be exposed. In contrast the training apparatus 10, the edible films corresponding to the first material 15 and second material 16 of the probe apparatus 11 are unflavoured.

[00143] Furthermore, the edible film corresponding to the first material 12 comprises a food dye corresponding to a first colour in the visible spectrum of the rodent e.g., green, and the film corresponding to the second material comprises a food dye corresponding to second colour in the visible spectrum of the rodent e.g., blue. In this way, the films corresponding to the first material 12 and second material 13 are visually distinguishable from one another to the rodent. The edible films corresponding to the first material 15 and second material 16 of the probe apparatus 11 will each comprise a third colour in the visible spectrum of the rodent e.g., black, and are therefore indistinguishable from one another, but are distinguishable from the edible films corresponding to the first material 12 and second material 13 of the training apparatus.

[00144] In use, the rodent is exposed to the training apparatus 10 e.g., which is mounted on the inside of the rodent's cage, for a period of time sufficient for the rodent to physically interact with, such as lick, ingest and/or bite, the first material 12 and the second material 13 of the training apparatus 10 to thereby condition the rodent to associate a spatial relationship between the region of the training apparatus 10 comprising the edible film having the attractive taste and the region of the training apparatus 10 having the aversive taste. The rodent will leave a detectable legacy of any such physical interaction with the training apparatus 10 by virtue of dissolving the edible film at the site at which the physical interaction occurs, thereby removing or modifying the coloured edible film at that site. After a period of time, the amount and distribution of physical interaction by the rodent with the first material 12 and second material 13 of the training apparatus 10 is determined by assessing the distribution and degree of colour change of the films corresponding to the first material 12 and second material 13. Any change(s) in colour can be conveniently detected by eye or using a device capable of pattern recognition or colorimetry.

[00145] Once the rodent has learned to physically interact with the region corresponding to the first material 12 only, or the rodent has learned to avoid the region corresponding to the second material 13, the rodent is considered to be "conditioned". A rodent which is conditioned will have learned to associate a likelihood of a positive outcome by interacting physically with the visible distinct region of the training apparatus 10 corresponding to the

edible film comprising the attractive substance and will have learned to associate a likelihood of negative outcome by interacting physically with the visible distinct region of the training apparatus 10 corresponding to the edible film comprising the aversive substance. Figure 3 is illustrative of a training apparatus 10 which has been exposed to a rodent and wherein that rodent has reached the conditioned criterion.

[00146] A rodent which is considered “conditioned” to the training apparatus 10 is then exposed to the probe apparatus 11 for a sufficient period of time to record judgement bias data from the rodent. The probe apparatus 11 is installed in the rodent’s cage e.g., preferably mounted on the wall corresponding to where the training apparatus 10 was previously installed, and left with the rodent for a period of time sufficient for the rodent to physically interact with, such as lick, ingest and/or bite, the first material 14 and/or the second material 15 of the probe apparatus 11.

[00147] Notwithstanding that the spatial arrangement of the first material 14 and second material 15 of the probe apparatus 11 relative to one another is substantially identical to the spatial arrangement of the first material 12 and the second material 13 of the training apparatus 10 relative to one another i.e., and is therefore represent a configuration which is familiar to the rodent, because the colour of the edible film corresponding to the first material 14 and second material 15 of the probe apparatus 11 is different to that of the first material 12 and the second material 13 of the training apparatus 10, the probe apparatus presents an “ambiguous” visual stimuli to the rodent with which there is no learnt association. Furthermore, because the first material 14 and second material 15 of the probe apparatus 11 are the same colour, they are visually indistinguishable from one another to the rodent other than by their spatial arrangement relative to one another. Accordingly, the ability to record judgement bias data using the probe apparatus 11 is predicated on the rodent’s learnt behaviour to physically interact with the spatial region of the training apparatus 10 corresponding to the film comprising the attractive substance in order to seek out a reward i.e., an expectation of a positive outcome, and to avoid the spatial region of the training apparatus 10 corresponding to the film comprising the aversive substance with which the animal associates an unpleasant experience i.e., an expectation of a negative outcome.

[00148] After a predetermined period of time, the amount and distribution of physical interaction by the rodent with the first material 14 and/or second material 15 of the probe apparatus 11 is determined by assessing the distribution and degree of change in colour of

the edible film corresponding to the first material 14 and second material 15. Any change(s) in colour are conveniently detected by eye or using a device capable of pattern recognition or colorimetry.

[00149] Whilst the edible films corresponding to the regions of the first material 14 and the second material 15 of the probe apparatus 11 represent an ambiguous stimulus to the rodent and do not comprise the attractive substance or the aversive substance i.e., bear no reward or unpleasant outcome following physical interaction by the rodent therewith, the affective state of the rodent e.g., whether the rodent is pessimistic or optimistic, will influence the likelihood and/or frequency of the rodent physical interacting with the first material 14 and/or the second material 15 of the probe apparatus 11. In this way, a rodent which demonstrates a relatively persistent search for the reward that they have come to expect from their physical interaction with the corresponding region of the cognate training apparatus 10 will be considered to be optimistic i.e., enjoying good welfare. This is because a rodent which is classified as being optimistic will be more likely to classify an ambiguous stimulus i.e., the edible films of the probe apparatus 11, as being associated with a positive outcome or reward. Accordingly, a rodent that is optimistic will be shown to reliably contact, scratch, lick, bite and/or or ingest the edible film corresponding to the first material 14 and/or second material 15 of the probe apparatus 11 more frequently than a rodent which is classified as being pessimistic e.g., enjoying poor welfare. Figure 4a is illustrative of a probe apparatus 11 which has been exposed to a rodent which is determined to be optimistic.

[00150] On the other hand, rodent that is determined to physically interact with the regions of the probe apparatus 11 which correspond spatially to the regions of the training apparatus 10 coated with edible film comprising the attractive substance only, if at all, will be considered to be pessimistic i.e., enjoying poor or less than desirable welfare. This is because, a rodent which is pessimistic will be more averse to the risk of suffering a negative outcome, such as associated with physically interacting with the edible film of the training apparatus 10 comprising the aversive substance, compared to a rodent which is classified as optimistic, and will be more likely to classify the ambiguous stimulus presented by the probe apparatus 11 as being associated with a negative outcome. Figure 4b is illustrative of a probe apparatus 11 which has been exposed to a rodent which is determined to be pessimistic.

[00151] The success of the data recordal system described herein for assessing welfare of a rodent assumes that judgement bias provides a reliable and objective indicator of the valence of an animal's emotional or affective state i.e., whether or not the animal is optimistic or pessimistic, and that the judgement bias data may therefore be used as a proxy for assessing animal welfare.

[00152] Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps,

[00153] Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is solely for the purpose of providing a context for the present invention. It is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed in Australia or elsewhere before the priority date of each claim of this application.

[00154] It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. For example, the sampling period may be adjusted or different signal processing techniques used. The sensor head and the interface box may be mounted in the same housing, or may have components distributed around a vehicle. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive.

WE CLAIM:

1. A data recordal system for determining judgement bias in an animal, said data recordal system comprising a training apparatus and a probe apparatus, wherein:
 - (a) the training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are distinct from one another, wherein:
 - (i) the first material comprises a substance which is attractive to the animal and the second material does not comprise the substance which is attractive to the animal;
 - (ii) the first and second materials are each configured to record a change in visual appearance thereof following physical contact by the animal therewith; and
 - (iii) the first and second materials are in a spatial relationship to one another;
 - (b) the probe apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are each distinct from the first and second materials of the training apparatus, wherein:
 - (i) at least the first material of the probe apparatus does not comprise a substance which is attractive to the animal;
 - (ii) the first and second materials of the probe apparatus are each configured to record a change in visual appearance thereof following physical contact by an animal therewith; and
 - (iii) the first and second materials of the probe apparatus are in a spatial relationship which mimics the spatial relationship of the first and second materials of the training apparatus.
2. The data recordal system according to claim 1, which is non-electronic.
3. The data recordal system according to claim 1 or 2, wherein the first and second materials of the probe apparatus are not distinct from one another.
4. The data recordal system according to any one of claims 1 to 3, wherein the first and second materials of the probe apparatus do not comprise:
 - (i) the substance of the first material of the training apparatus which is attractive to the animal; or
 - (ii) do not comprise any substance which is attractive to the animal.
5. The data recordal system according to any one of claims 1 to 4, wherein the first and second materials of the training apparatus and the first and second materials of the probe apparatus each have a surface area configured to be physically contacted by the animal.

6. The data recordal system according to any one of claims 1 to 5, wherein one or more of the material(s) of the training apparatus and/or probe apparatus is/are configured to record a non-reversible change in visual appearance thereof following physical contact by the animal.
7. The data recordal system according to claim 5 or 6, wherein the physical contact by the animal is selected from scratching, licking, ingesting, biting and/or rubbing a surface area of the material(s).
8. The data recordal system according to claim 6, wherein the first and/or second material(s) of the training apparatus and/or probe apparatus is/are configured such that a degree of non-reversible change in visual appearance recorded by the first and/or second material(s) of the training apparatus and/or probe apparatus is correlated with a degree of physical contact by the animal with the material(s).
9. The data recordal system according to claim 6 or 8, wherein the non-reversible change visual appearance is a non-reversible change in shape, texture and/or colour.
10. The data recordal system according to any one of claims 1 to 9, wherein one or more of the first and second materials of the training apparatus and/or probe apparatus is ingestible by the animal.
11. The data recordal system according to any one of claims 1 to 10, wherein the substance which is attractive to the animal has a taste and/or scent which is attractive to the animal.
12. The data recordal system according to any one of claims 1 to 11, wherein the second material of the training apparatus comprises a substance which is aversive to the animal.
13. The data recordal system according to claim 12, wherein the substance which is aversive to the animal has a taste and/or scent which is aversive to the animal and/or causes discomfort to the animal.
14. The data recordal system according to any one of claims 1 to 13, wherein the first and second materials of the training apparatus are visually distinct from one another and/or wherein the first and second materials of the training apparatus are visually distinct from the first and second materials of the probe apparatus.
15. The data recordal system according to claim 14, wherein visual distinctiveness is by virtue of colour, shape and/or texture.

16. The data recordal system according to any one of claims 1 to 15, wherein the spatial relationship of the first and second materials of the training apparatus is sufficient to condition the animal to associate a corresponding spatial relationship between the region comprising the substance which is attractive to the animal and the region which does not comprise the substance which is attractive to the animal.
17. The data recordal system according to any one of claims 1 to 16, wherein the spatial arrangement of the first and second materials of the probe apparatus is substantially identical to the spatial arrangement of the first and second materials of the training apparatus.
18. The data recordal system according to any one of claims 1 to 17, wherein the training apparatus and probe apparatus each comprise a physical support which has a substantially planar form.
19. The data recordal system according to claim 18, wherein the training apparatus and/or probe apparatus is provided in the form of a card.
20. A method of recording judgement bias in an animal, said method comprising:
 - (i) exposing the animal to a training apparatus of the data recordal system of any one of claims 1 to 19 for a period of time sufficient for the animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not comprise the attractive substance;
 - (ii) exposing the animal which has been conditioned at (i) to a probe apparatus of the data recordal system of any one of claims 1 to 19 for a period of time sufficient for the animal to physically interact with one or both of the first and second materials of the probe apparatus to thereby record data on judgement bias.
21. The method according to claim 20, wherein:
 - (i) physical interaction with the first and second materials of the training apparatus by the animal, and physical interaction with the first and/or second materials of the probe apparatus by the animal, comprises one or more of scratching, licking, ingesting, biting and/or rubbing one or more surface areas of the first and second materials.
22. The method according to claim 21, wherein evidence of the physical interaction by the animal is in the form of a change in visual appearance of the first and/or second material(s).

23. The method according to claim 22, wherein the change in visual appearance of the first and/or second material(s) is a change in one or more of a colour, texture and/or shape thereof.
24. The method according to claim 22 or 23, further comprising detecting change(s) in the visual appearance of the first and second materials of the training apparatus at (i) to determine whether or not the animal is conditioned.
25. The method according to any one of claims 20 to 24, wherein the animal is conditioned at (i) when:
- (a) the animal associates a likelihood of a positive outcome with interacting physically with the region of the training apparatus comprising the material comprising the attractive substance and associates a likelihood of neutral or negative outcome with interacting physically with the region of the training apparatus comprising the material which does not comprise the attractive substance;
 - (b) the animal selectively interacts physically with the material of the training apparatus comprising the attractive substance;
 - (c) the animal avoids physical interaction with the region of the training apparatus comprising the material which does not comprise the attractive substance; and/or
 - (d) the animal only interacts physically with the region of the training apparatus comprising the material comprising the attractive substance.
26. The method according to any one of claims 20 to 25, wherein evidence of the animal having physically interacted with one or more of the first and second materials of the probe apparatus provides data on judgement bias.
27. A probe apparatus for recording judgement bias in an animal, said probe apparatus comprising a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are not distinct from one another, and wherein:
- (i) at least the first material of the probe apparatus does not comprise a substance which is attractive to the animal;
 - (ii) the first and second materials of the probe apparatus are each configured to record a change in visual appearance thereof following physical contact by an animal therewith; and
 - (iii) the first and second materials of the probe apparatus are in a spatial relationship to one another; and
- wherein said probe apparatus is configured to record data on judgement bias in an animal which has been pre-conditioned with a training apparatus,
- wherein the training apparatus comprises a first region comprising a first material and a second region comprising a second material, wherein said first and second

materials of the training apparatus are distinct from one another and are each distinct from the first and second materials of the probe apparatus, and wherein:

- (iv) the first material of the training apparatus comprises a substance which is attractive to the animal and the second material of the training apparatus does not comprise the substance which is attractive to the animal;
- (v) the first and second materials of the training apparatus are each configured to record a change in visual appearance thereof following physical contact by the animal therewith;
- (vi) the first and second materials of the training apparatus are in a spatial relationship to one another which mimics the spatial relationship of the first and second materials of the probe apparatus; and
- (vii) the spatial relationship of the first and second regions of the training apparatus is sufficient to condition an animal to associate a corresponding spatial relationship between the material comprising the attractive substance and the material not comprising the substance attractive substance.

28. A training apparatus for conditioning an animal, said training apparatus comprising a first region comprising a first material and a second region comprising a second material, wherein said first and second materials are distinct from one another, wherein;

- (i) the first material comprises a substance which is attractive to the animal and the second material does not comprise the substance which is attractive to the animal;
- (ii) the first and second materials are each configured to record a change in visual appearance thereof following physical contact by the animal therewith; and
- (iii) the first and second materials are in a spatial relationship to one another sufficient to condition an animal to associate a corresponding spatial relationship between the material comprising the attractive substance and the material not comprising the substance attractive substance.

29. The training apparatus according to claim 28, configured to:

- (a) condition an animal to associate a likelihood of a positive outcome with interacting physically with the region comprising the material comprising the attractive substance and associate a likelihood of neutral or negative outcome with interacting physically with the region comprising the material which does not comprise the attractive substance;
- (b) condition an animal to selectively interact physically with the material comprising the attractive substance;
- (c) condition an animal to avoid physical interaction with the region comprising the material which does not comprise the attractive substance; and/or
- (d) condition an animal to interact physically with the region of the training apparatus comprising the material comprising the attractive substance only.

30. A method of recording judgement bias in an animal, said method comprising exposing the animal to a probe apparatus according to claim 27 for a period of time sufficient for the animal to physically interact with one or both of the first and second materials of the probe apparatus to thereby record data on judgement bias, wherein the animal has been previously conditioned using a training apparatus according to claim 28 or 29 by exposing the animal to the training apparatus for a period of time sufficient for the animal to physically interact with the first and second materials of the training apparatus to thereby condition the animal to associate a spatial relationship between a region of the training apparatus comprising a material comprising an attractive substance and a region of the training apparatus comprising a material which does not comprise the attractive substance.
31. A method of determining an affective state of an animal comprising:
- (i) performing a method according to any one of claims 20 to 26 and 30;
 - (ii) detecting change(s) in the visual appearance of the first and/or second materials of the probe apparatus to detect evidence of judgement bias; and
 - (iii) determining the affective state of the animal based on a degree of change in visual appearance of the first and second materials detected at (ii).
32. The method according to claim 31, wherein substantially no change in visual appearance of the second material of the probe apparatus which does not comprise the attractive substance is indicative of an animal which is pessimistic.
33. The method according to claim 31 or 32, wherein a detectable change in visual appearance of the first and second material(s) of the probe apparatus is indicative of an animal which is optimistic.
34. The method according to any one of claims 31 to 33, wherein the affective state of the animal is an objective measure of the animal's state of welfare.
35. The method according to claim 32 to 34, wherein an animal which is determined to be pessimistic suffers from poorer welfare relative to a corresponding animal which is determined to be optimistic.
36. The data recordal system according to any one of claims 1 to 19 packaged with instructions for use in a method according to any one of claims 20 to 26 or 30 to 35.
37. The probe apparatus according to claim 27 or the training apparatus according to claim 28 or 29, packaged with instructions for use in a method according to any one of claims 20 to 26 or 30 to 35.

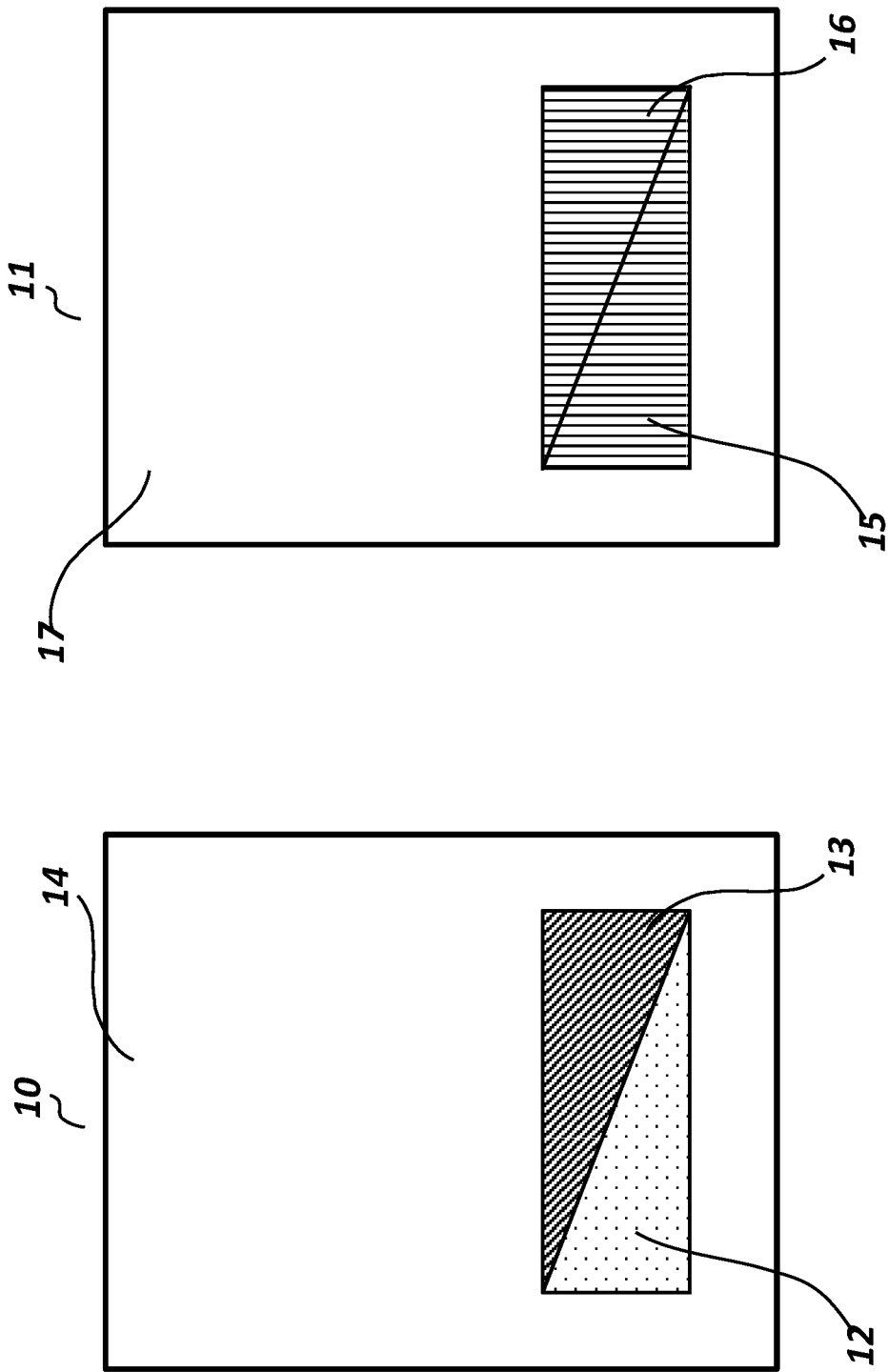


Fig. 1

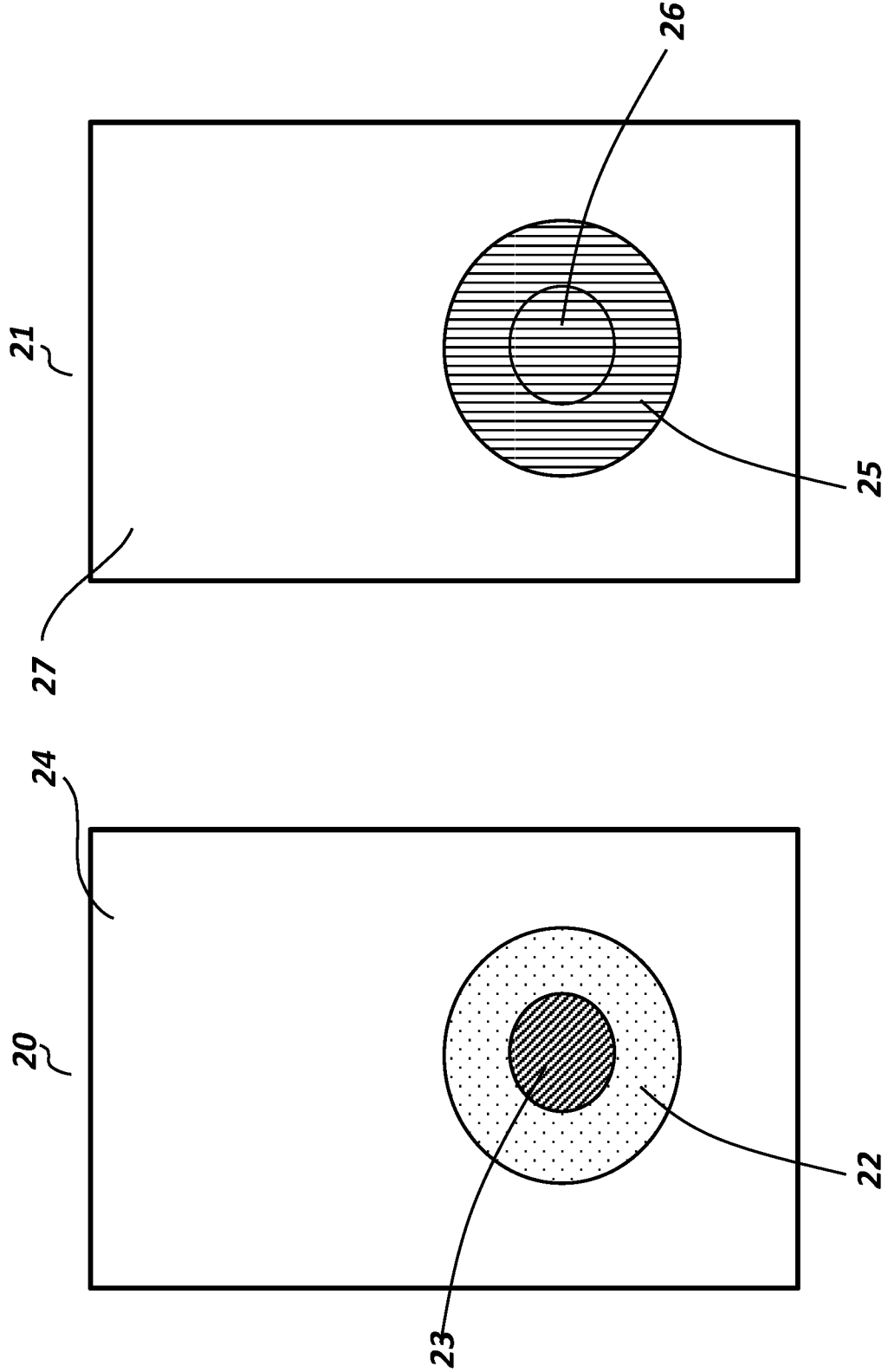


Fig. 2

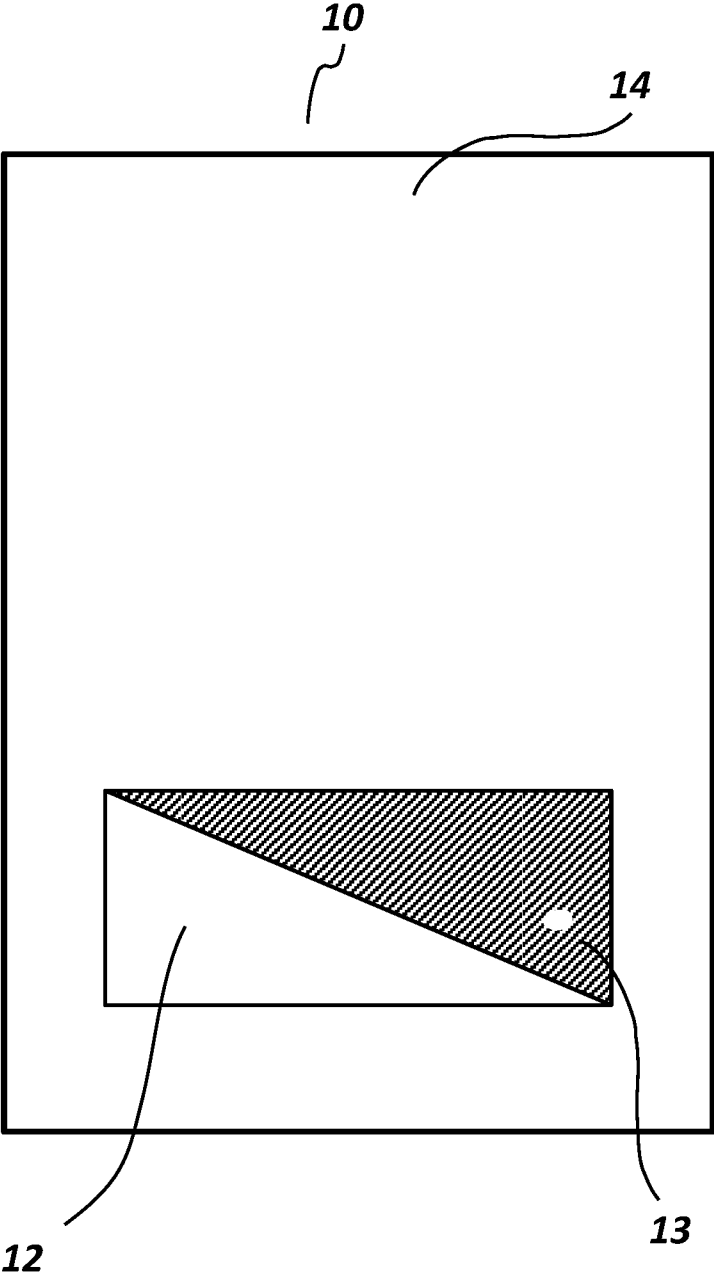


Fig. 3

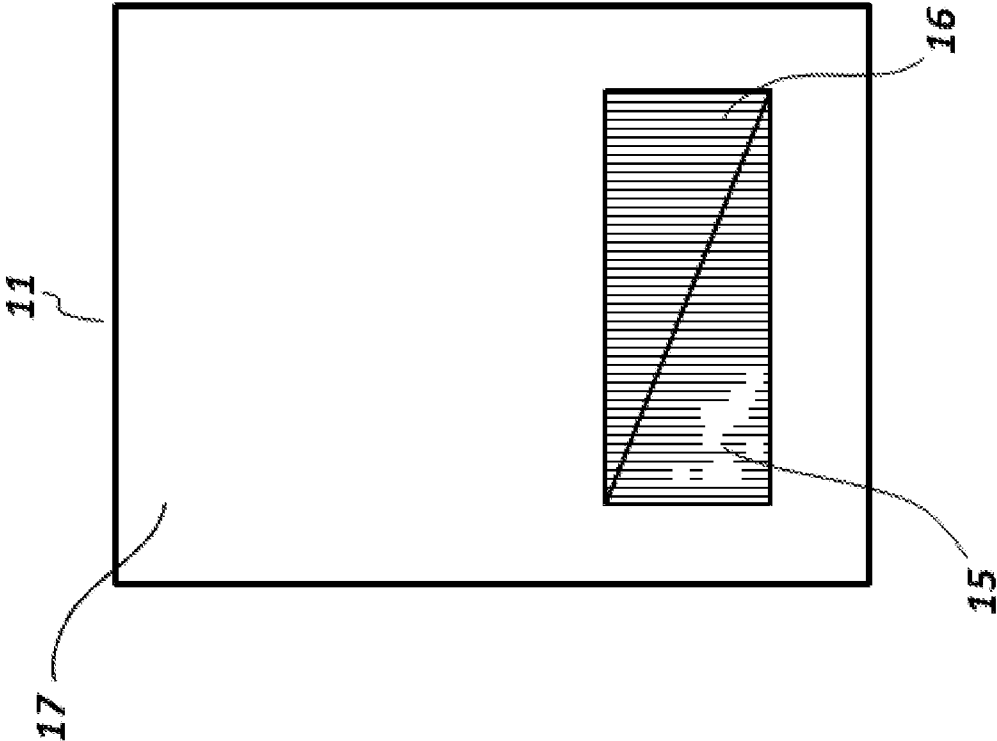


Fig. 4b

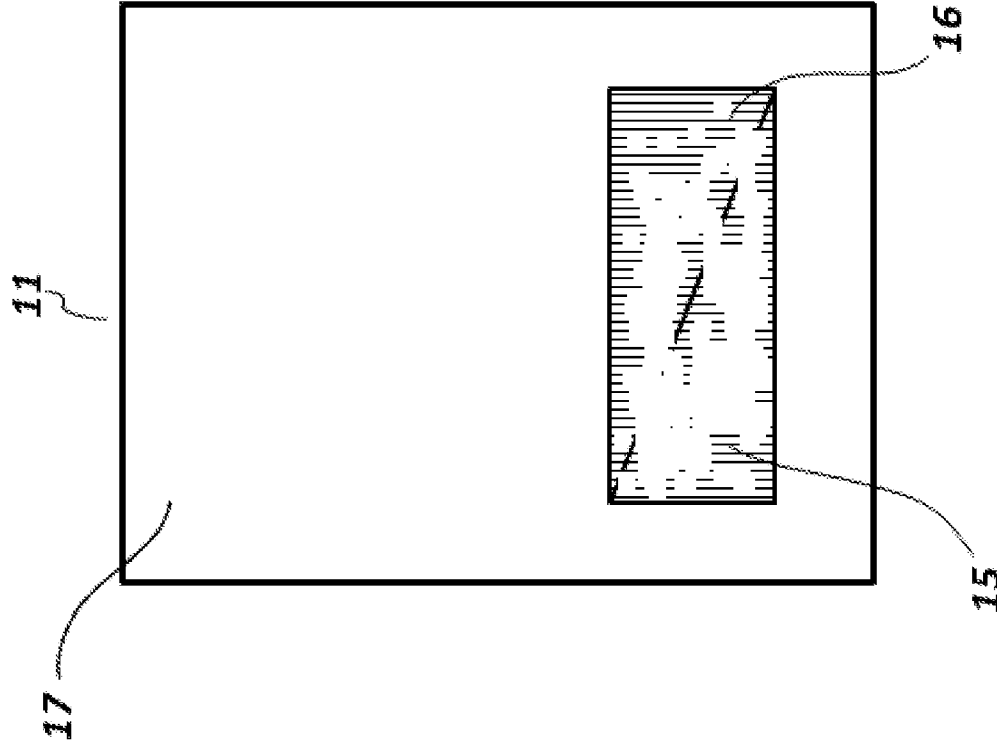


Fig. 4a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2015/050142

A. CLASSIFICATION OF SUBJECT MATTER

A01K 15/00 (2006.01) A61B 5/16 (2006.01) A61B 5/00 (2006.01) G09B 19/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIAP, WPI, EPODOC: IPC, CPC: A01K15/- , A01K29/005 , G09B19/-, A61B5/16/-; Keywords: record, determine, test, method, assess, system, personality, optimistic, pessimistic, cognitive_bias, , judgement_bias, profile, animal, pet, dog, canine, visual, tactile, taste, smell, scent and like terms.

FullText databases searched using keywords as above.

Google, Google Scholar and Google Patents with keywords: animal welfare, determine animal judgement bias, optimistic, pessimistic, cognitive bias, non-invasive and like terms.

Inventor name searched in Google Scholar, Espacenet and AusPat.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 25 May 2015		Date of mailing of the international search report 25 May 2015	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Naveen De Silva AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832429	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/AU2015/050142
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BRYDGES, N. et al., 'Environmental enrichment induces optimistic cognitive bias in rats', Animal Behaviour 81 (2011) , pages 169-175. Figure 1	28
A	BURMAN, O. et al., 'Using judgement bias to measure positive affective state in dogs' Applied Animal Behaviour Science, Volume 132, Issues 3-4, July 2011, Pages 160-168.	
A	Dog Optimism [retrieved from internet on 07 May 2015] <URL: http://www.dogoptimism.com/Further_Reading.html > published on October 2013 as per the web page.	

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/AU2015/050142	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			