

Results of the GR8 /RSPCA Global Survey on Effects of Enrichment on Data Quality

BACKGROUND

In the last edition of *The Enrichment Record*, the article 'Facts and Demonstrations' reviewed the reasons for inconsistencies in the provision of environmental enrichment for animals used in research and testing, including a discussion of beliefs that experimental variability will increase, or a confound will be introduced, affecting data quality (Hawkins 2014).

The article identified three main areas of concern relating to this:

1. The validity of the science within an individual project, if another variable is introduced;
2. Whether or not the data can be compared with those obtained from studies conducted without enrichment; and
3. An ethical issue—whether greater variability will necessitate an increase in animal numbers to ensure that results are significant, trading off refinement and reduction against one another.

Assumptions are frequently made about all three of these points, hence the title 'Facts and Demonstrations', which was taken from a quote by

John Ruskin: "the work of science is to substitute facts for appearances, and demonstrations for impressions". The article discussed the scientific, practical and ethical bases for each of the above areas of concern, suggested some action points to support the provision of enrichment (and encourage wider reporting of husbandry refinements) and asked readers to participate in a survey to explore their views and beliefs relating to the effects of enrichment on data quality.

The introductory text to the survey set the context by stating that there is widespread support for the concepts that 'better welfare equals better science' and that enrichment can improve welfare. The text also explained that practices vary with respect to the provision of enrichment, the interpretation of results from animals with or without enrichment, and the way in which animal husbandry is reported in the literature. The intention of the survey was described as helping two stakeholders (GR8 and the RSPCA) to understand people's views, beliefs and practices, and to identify any training or resource needs that ought to be addressed with the

aim of helping to improve both science and animal welfare.

"Unless enrichment is clearly defined ('enriched environment' means different things according to different institutions) it is quite impossible to be sure that responses are consistent." —Participant Comment

SURVEY RESULTS AND DISCUSSION

The survey ran between 6 January 2014 and 21 February 2014. It was publicized via *The Enrichment Record* article and by using online forums such as CompMed, LAREF and laboratory animal science-related user groups on LinkedIn. The aim was to encourage a wide range of respondents, holding a variety of attitudes towards enrichment and beliefs about its effects on data quality. With the aim of maximizing the number of responses, only the first three questions (on roles,

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establishment type and location) were mandatory, and people could then go on to answer as many or as few as they liked.

There were inevitably some flaws in the survey; for example, it was not possible to obtain a stratified sample of respondents. The limitations of online forms make it difficult to provide sufficient information to explain the context for each question in a way that will be meaningful to all and clarify the differences between the options. Supplementary text for each question was also kept brief, with the aim of maximizing drop-outs as people worked through the survey. The drop-out rate did prove to be low (at least 332 people answered every question), but some respondents perceived the text to be leading (6 comments in the free text box, one separate email), or not include sufficient information (3 comments), or they felt that important questions or options were missing (3 comments).

Notwithstanding the above, there are some useful outcomes that are relevant to the aims of the survey, and all of the above limitations have been taken into account when presenting and discussing the results below. As the survey results are not suitable for statistical analysis, they have been described and discussed concomitantly in the sections below, with conclusions (see page 12).

Respondent demographics

A total of 343 people responded to the survey. Tables 1 to 3 list their roles, establishment types and geographical locations.

Table 1. Roles of respondents to enrichment survey

(NB: the total in this table adds up to 473, as respondents could tick more than one role)

Role	Number of respondents
Researcher/scientist	112
Animal technologist or care staff	112
Veterinarian	85
Member of ethical or animal care and use committee	74
Other role within a facility conducting animal research or testing	33
Regulator	9
Other	48

Table 2. The kinds of establishment in which they work

Establishment type	Number of respondents
Academic/university	182 (53 %)
Industry—pharmaceutical establishment	51 (15 %)
Medical or veterinary research institute	41 (12 %)
Government agency	26 (8 %)
Industry—Contract Research Organisation	25 (7 %)
Other	18 (5 %)

Table 3. Their location (based on the United Nations world region listing)

World region	Number of respondents
North America	175 (51 %)
Europe	128 (37 %)
Canada	20 (6 %)
Australia/New Zealand	5
China	4
Latin America and the Caribbean	4
Africa	2
Asia (other than China, India or Japan)	2
India	1
Japan	1
Oceania (other than Australia/New Zealand)	0
Sub-saharan Africa	0

Individual countries that respondents chose to specify included Australia, Belgium, Brazil, Denmark, England, Finland, France, Hungary, Israel, Italy, Malawi, Netherlands, Portugal, Scotland, Spain, St Kitts, Switzerland, UK and Venezuela.

Attitudes towards enrichment

When asked whether they regarded the provision of environmental enrichment as a basic necessity for animals, 336 people responded 'yes' and 5 answered 'no'.

This question was not mandatory, but just two people did not answer it and the vast majority accepted that animals need enrichment. This was also borne out by the responses to a question on acceptance of scientific evidence relating to enrichment, which all 343 respondents answered (figure 1).

Figure 1. Responses to the question: 'In your view, is there adequate scientific evidence that animals benefit from enrichment?'

In the figure below, over 95% of all 343 respondents agreed that

there is scientific evidence that enrichment benefits at least some species, with 80% of all respondents choosing the option that did not include a caveat relating to different species. The survey also asked about people's beliefs relating to the effects of enrichment on data quality. Of the 341 respondents who replied to this question, 294 (86%) agreed that, in general, enrichment had a positive effect, 1 believed the effect was negative, 14 (4%) thought it made no difference and the remaining 32 (9%) did not know.

"I STRONGLY believe that reduced suffering in more animals is better than increased suffering in fewer animals." — Participant Comment

Broadly speaking, in light of this, the survey results should be considered as representative of those who accept the scientific basis and the need for enrichment, and generally believe that it improves the science, rather than derived from the entire population of people involved in animal research and testing. Presumably, potential respondents who were less supportive of enrichment may not have been motivated to fill out the survey form, and/or may be less likely to read *The Enrichment Record* and to subscribe to online fora on animal use.

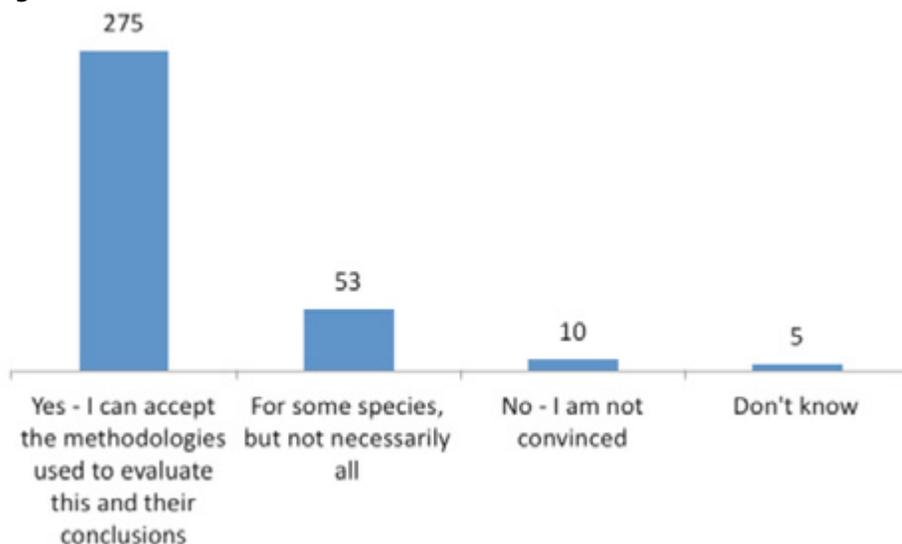
The responses to a further question also suggest that most respondents worked in an environment that was supportive of husbandry refinements (figure 2).

Figure 2. Responses to the question: 'Is enrichment provided for animals at your facility?'

(see chart on page 8)

The two different responses 'only withheld if there is sound scientific justification' and 'sometimes' were included to allow respondents to clarify if, where enrichment was sometimes withheld, they knew whether there was a justifiable reason for this. Of the 339 respondents, 90% believed that enrichment

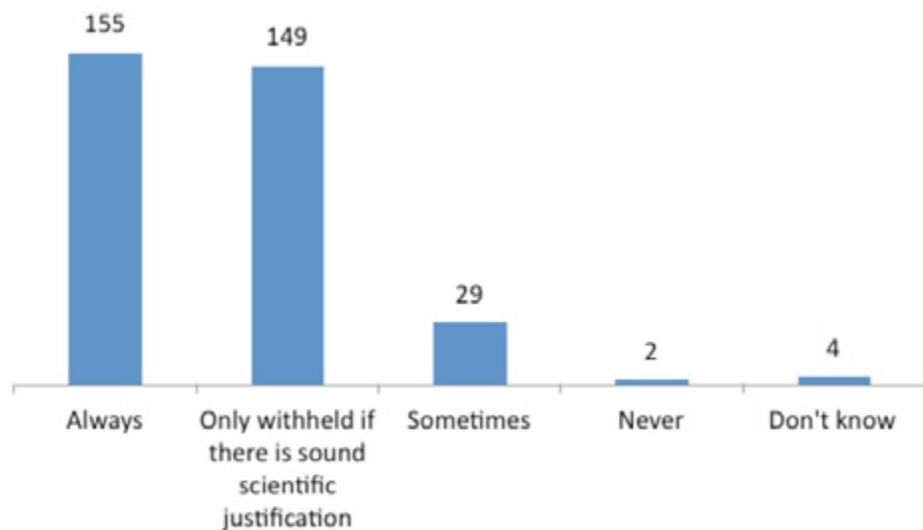
Figure 1



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was always provided at their facility, or provided unless there was sound scientific justification otherwise.

Figure 2



Implementing enrichment in practice

The majority of respondents were supportive of enrichment, believed that it had scientific benefits, and worked in environments where its provision was the norm, but there were still some issues regarding untested assumptions about the effects of enrichment.

For example, 341 people responded to the question 'Have you ever withheld enrichment in the belief that data will be negatively affected, but not empirically evaluated this?', of whom 98 felt that it was not relevant to them. Of the remaining 243 respondents, 45 (18%) answered 'yes', whereas 187 (77%) had never made

that assumption and 11 (5%) had done an evaluation study. This implies that even people who accept that environmental enrichment is a basic need will still sometimes withhold it on the basis of untested assumptions.

A further question aimed to establish whether people were prepared to challenge colleagues who wanted to withhold enrichment, including asking them for evidence to justify their decision. There were 341 responses to this question, 151 of which were 'not applicable to me'. The remainder of the responses are listed in table 4.

Table 4. Responses to the question: 'Have you ever challenged a colleague who wanted to withhold enrichment, and asked them for evidence to help justify this?'

Response	Number of respondents
Yes—successfully (they did a pilot study, consulted the literature, or sought further advice)	119 (63%)
Yes—unsuccessfully (they did not change their mind and nobody backed me up)	42 (22%)
No—it was their choice and I didn't see it as an issue	18 (9%)
No—I didn't agree with them, but I knew it wouldn't get me anywhere	11 (6%)

The results suggest that 85% of respondents who felt that the question was relevant to them were prepared to challenge colleagues who made unfounded, negative assumptions about enrichment, with a success:failure rate of around 3:1. However, the remaining 15% were not motivated to raise the issue, either because they did not feel they would be listened to or they apparently did not see it as their place to do so.

Awareness of the literature and issues relating to implementation

As outlined in *The Enrichment Record* article which led to the survey, there is a growing literature setting out the effects of enrichment on data quality (e.g. Eskola et al. 1999, Baumans et al. 2003, Würbel et al. 2005, Mikkelsen et al. 2010, Toth et al. 2011). Various studies have found that enrichment has effects on variability or data quality that are significant, or that it has effects that are not significant, or that there are no detectable effects at all. This indicates that it is not possible to make sweeping assumptions about the effect of enrichment on variability, and it is important to ensure that any effects are properly evaluated and the results acted on appropriately (Hawkins 2014). The majority of respondents to the survey appeared to have a good level of awareness of the most suitable way to interpret and implement results of studies aiming to evaluate effects on data quality (table 5). Of the 332 people who answered, the majority gave the most appropriate response with respect to taking both welfare and science into account, with the aim of reducing suffering, optimizing translatability and ensuring animals are not wasted.

Table 5. Responses to the question: 'Rats on an arthritis study are group housed and provided with extra nesting material—and the disease progression is different from rats individually housed with minimal nesting material. What is the right thing to do?'

Response	Number of respondents
Get advice from a statistician (unless you have the expertise) to see whether any changes need to be made to the experimental design; also see whether the results from these animals yield any fresh insights into the scientific question you are asking. Keep the new protocol unless there are pressing scientific reasons not to	275 (83%)
Assume that the data from group housed animals with extra nesting material is more relevant and transferable to the human condition, and continue with the new husbandry protocol	51 (15%)
Go back to individual housing and remove the extra nesting material—the results have to be comparable	6 (2%)

It is clearly essential to be aware of the literature on the effects of enrichment on variability, in order to help inform decisions in situations such as the hypothetical study in table 5. Knowledge of the literature is also important with respect to awareness of current good practice approaches to enrichment per se, as well as understanding and interpreting its effects. With this in mind, the survey asked whether respondents were aware of the literature on the effects

of enrichment on data quality. A total of 342 people responded, of whom 228 (67%) were aware but had not reviewed it in depth, 96 (28%) were aware and followed it closely, and 18 (5%) were unaware. This indicates that the population of respondents already had an interest in the subject matter of the survey and a good level of awareness. The survey also asked how information on enrichment became available in respondents' facilities (figure 3).

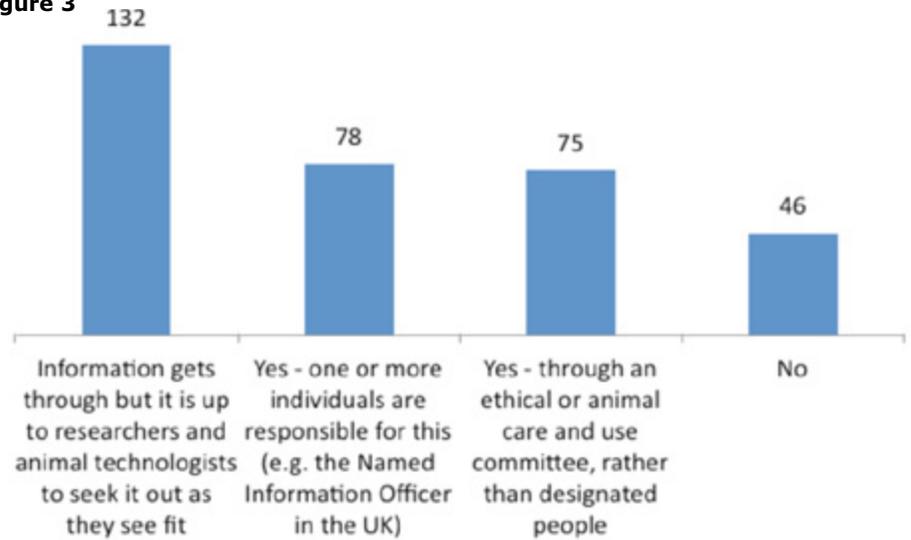
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Figure 3. Responses to the question: 'Does your facility have a system for researching, retrieving and assessing new information on enrichment?'

Of the 331 responses, almost half (46%) reported that there was a system for channeling new information on enrichment into the facility, in the form of one or more individuals or a committee. Publications and other communications on enrichment can easily be overlooked without such systems, for a number of reasons including low awareness of journals, discussion fora and meetings that feature enrichment, or an establishment culture that simply does not recognize the necessity of regular review of new information on enrichment. The lack of a formal system (or knowledge of such a system) indicated in the remaining responses is therefore a concern.

There can be a perception that the requirements of some regulatory bodies preclude husbandry refinements such as enrichment, e.g. in tests to generate safety assessment data. The survey asked a question to explore respondents' beliefs about this. A total of 337 people answered the question 'Animals on studies carried out for regulatory toxicology purposes cannot

Figure 3



be provided with enrichment true or false?' Of these, 198 (59%) agreed with the option 'False—there is nothing in regulatory requirements that precludes husbandry refinements', 126 (37%) did not know and 13 (4%) agreed with the statement 'True—it will affect data and regulators (e.g. OECD) will not accept the results'. The low level of agreement with the 'true' option is encouraging and to be expected from the other answers given in the survey, and the number of 'do not knows' is not necessarily meaningful given that these respondents may not have been involved in animal use to fulfill regulatory requirements.

Reporting enrichment in publications

It is important to include information on animal housing, husbandry and care in publications; both to help disseminate and encourage good practice

with respect to refinement, and to ensure all potential variables have been described so that the results can be adequately interpreted, compared with those from other facilities and replicated if necessary.

There are currently serious issues with the level of reporting in biomedical research papers (ILAR 2011, Kilkenny et al. 2009, Baker et al. 2014) and a number of reporting guidelines (e.g. ILAR 2011 and ARRIVE, Kilkenny et al. 2010) have been drawn up to help deal with this problem. The survey asked whether respondents included information about enrichment, including reasons for not providing it (if applicable) in materials and methods sections of their publications at the time of submission. There were 339 respondents to this question, 204 of whom felt it did not apply to them. Of the remainder, 107

(79%) selected the option 'Yes—this is important and relevant information', 20 (15%) selected 'No—it is irrelevant' and 8 (6%) selected 'No—the editor will tell me to remove it'.

It was surprising to see respondents (albeit a minority of 20 people) agree with the statement that enrichment is irrelevant with respect to materials and methods sections, especially when some of these must have agreed with the options that enrichment is a basic necessity and there is scientific evidence that at least some species benefit (just 5 people disagreed with each of these). However, the low level of agreement that information about enrichment was not included in the belief that the editor will instruct the author to remove it was more encouraging. Editorial policies with respect to information about animal use, ethics and the Three Rs are certainly improving (Osborne in press) but more challenge from authors is an essential component of the drive for further progress in reporting standards.

In response to concerns about the level of enforcement of the ARRIVE guidelines (e.g. Baker et al. 2014), the survey included a question about these. Of the 340 people who answered this, 189 felt that it was not applicable to them. The remaining responses are listed in Table 6.

Table 6. Responses to the question: 'Do you write up your papers according to the ARRIVE guidelines?'

Response	Number of respondents
I hadn't heard of the ARRIVE guidelines	97 (64%)
Yes—in part, I adapt them on a case by case basis	33 (22%)
Yes—I follow them to the letter	18 (12%)
No—the editors of the journals will tell me to remove most of the information they require	2 (1.2%)
No—I think they require too much information	1 (0.6%)

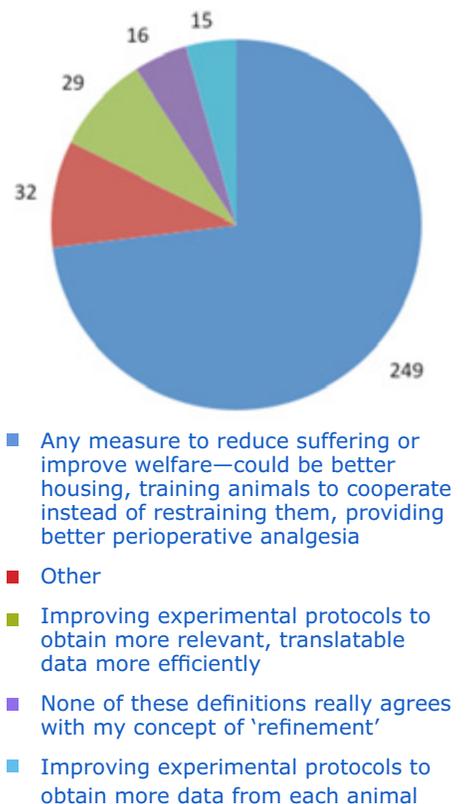
Given that the survey responses came from a number of regions, with half from the US, the level of awareness of the ARRIVE guidelines among this audience is good. With hindsight, it would have been better to include other options such as ILAR. The responses to the options asking to what extent people follow ARRIVE are of interest, with around a third following them to the letter and two thirds adapting them on a case-by-case basis. The ARRIVE guidelines are intended to be flexible, so either approach to implementing them can be appropriate (<http://www.NC3Rs.org.uk/ARRIVE>).

Other questions

The three final questions in the survey were not directly concerned with beliefs about enrichment and its impact on data quality, but were included because they could provide some useful information relating to stakeholders' views on some topical issues.

One of these addressed the definition of 'refinement', as in the experience of both the RSPCA and GR8 this can sometimes be misinterpreted. The results are shown in figure 4.

Figure 4. Responses to the question: 'What does 'refinement' mean?'



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Most people (249 of 341 respondents) agreed with the option that corresponds to the consensus definition of refinement, which expresses the concept in terms of its effect on the animal rather than the data. A smaller proportion of the respondents (13%) defined refinement in terms of improving the experimental protocol to obtain more, or more translatable, data. While there may be ethical advantages associated with both of these approaches—provided that no additional suffering is caused—it would be better for people to work to the correct and original definition of refinement that is centered on the animal’s experience. Another related question asked directly about the relationship between the two ‘Rs’ of refinement and reduction. Answers from the 342 respondents are in table 7.

Table 7. Responses to the question: ‘On principle, what should come first; reducing animal numbers or reducing suffering?’

Response	Number of respondents
Reducing suffering, even if numbers increase	167 (49%)
I can’t answer this ‘on principle’; I can only apply to specific cases	147 (43%)
Reducing numbers, even if some individuals suffer more	18 (5%)
Don’t know	10 (3%)

This question was included because the RSPCA and GR8 have both encountered confusion regarding this issue, as the pressure to reduce numbers can sometimes lead practitioners to believe that this is the ultimate goal when designing experimental protocols. However, the majority of respondents to the survey recognized that reduction is not necessarily the overriding aim, and that the suffering of the individual often comes first. This reflects the apparently good level of awareness of ethical and welfare issues among respondents.

Finally, the survey asked: ‘Does the public have a right to know what members of the scientific community are doing to reduce suffering and improve welfare?’ Of the 341 respondents to this question, 319 (94%) agreed with the statement ‘Yes—it is important to the public and openness is a good thing’. Of the remainder, 13 (4%) did not have a view, 5 (1%) felt that the public should trust the scientific community and 4 (1%) agreed with the option ‘No—it just highlights the fact that animals can suffer and could cause more problems’. It was encouraging to see that respondents recognized the importance of good communication with the public, not least because the public directly or indirectly funds life science

research and is concerned about laboratory animal welfare (Ipsos MORI 2012).

CONCLUSIONS

The responses to this survey indicate that these results represent the views of people who regard enrichment as a basic necessity for animals, accept the scientific evidence that animals benefit from its provision, believe that enrichment has a positive effect on data quality, and who work in an environment that is broadly supportive of providing enrichment for animals. They have a good level of awareness of the literature on the effects of enrichment, are prepared to encourage others to provide it, and recognize that it is relevant to the science and should be reported in publications. They understand the principle of refinement and recognize that the public has a right to know what they are doing to reduce suffering and improve welfare.

However, the responses identified four issues of concern that are likely to be more widespread in general, given that they arise among the respondents to the survey. These are:

1. Withholding environmental enrichment on the basis of untested assumptions about its impact on data quality
2. A lack of motivation to challenge colleagues who do not provide enrichment, or lack of support when raising the issue

3. Perceptions that enrichment is irrelevant to materials and methods sections of publications
4. Lack of a defined system (either via designated individual(s) or an ethical or animal care and use committee) for researching, retrieving and assessing new information on enrichment

These four issues are all addressed within the action points in the original 'Facts and Demonstrations' article. However, on the basis of the survey results, some have particular implications for training providers (1-3), regulators (1,4) the ethical or animal care and use committee (1,2,4) and journal editors (3), as well as for researchers, veterinarians and animal technologists and care staff. It would be a very positive step for those undertaking all of these roles to consider whether any of the four concerns might apply to them, and whether they could do more with respect to all of the original action points—and both GR8 and the RSPCA will make sure our training (and other) initiatives also include a focus on these.

"I believe that in the future, failure to provide adequate enrichment and species appropriate housing for our research subjects will be viewed upon in the same way that the absence of a suitable program of veterinary care would be considered unacceptable today."—Participant Comment

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