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Enhancing welfare of zebra finches through the use of environmental enrichment

Gordon Gray

*Institute of Biodiversity, Animal Health and Comparative Medicine,
University of Glasgow, Graham Kerr Building G129QQ*

Correspondence: Gordon.Gray@glasgow.ac.uk

Abstract

This article will describe alterations made by the University of Glasgow to increase the welfare of our zebra finches by providing them with a more complex environment to engage with. I will describe how we have maximised the enrichment potential within the cages giving our finches greater choices of activity, thus improving their quality of life. Furthermore, I will discuss how adjustments made to the macro environment have positively impacted our finches, enabling them to display a range of natural behaviours that would not normally occur in a research environment.

Introduction

Captive animals are provided with a 'care free' life. Food and water is supplied, there are no predators to avoid, mates are quite often selected for them and social groupings are usually stable and structured. But does this make for a complete and varied life? The skills needed to evade predators, attract mates and to forage, challenge an animal's instinct and intelligence, preventing boredom and increasing the physical and psychological

welfare of the animal. In a research environment, animals are unable to express and display these types of behaviour naturally, and instead need to be stimulated in order to keep them healthy and active. This is where the role of environmental enrichment comes in.

The Zebra finch

Zebra finches (*Taeniopygia guttata castanotis*) are small passerines native to Australia. Their favoured habitat is dry wooded areas near watering holes, and they typically live in large flocks of up to 100 birds or more. The name 'zebra finch' is gained because of the black and white striped markings on their tail feathers that are likened to that of a zebra's coat. Zebra finches are one of the most widely used passerines in avian research alongside the European starling (*Sturnus vulgaris*) and the house sparrow (*Passer domesticus*). Passerines are useful and interesting research subjects and are particularly valuable because their characteristics differentiate from other laboratory animals such as the production of intricate vocalisation (Bateson and Feenders, 2010). The University of Glasgow has maintained a zebra finch colony for over 25

years and they are currently involved in a 5-year study looking at aspects of stress and longevity.

The Cage environment

The majority of the finches at Glasgow are housed in experimental cages, although some are housed in large aviaries that allow for more social interaction and space for flight. Zebra finches are gregarious and we keep all of our finches in social groups, with a maximum stocking density of ten birds per double cage (120cm x 50cm x 50cm) and sixty birds per large aviary (2m x 2m x 2m). Our main objective when using enrichment in our cages is to create conditions that our birds can thrive in, whilst still utilising space and complying with research requirements. Within the cages we have provided a specific environment that has been evaluated on the basis of the finches' needs, allowing them to perform essential components of their behavioural repertoire.



Figure 1 shows the basic recommended set up under the current 2016 guidelines

Variation in perches

Wild birds are able to perch on a variety of objects and surfaces; however, in a research environment the options are unfortunately limited. Birds are on their feet for the majority of their lives and it is vitally important they remain in the best condition as possible. Diversity amongst perches is crucial in

insuring the health and welfare of our zebra finches and has played a large role in preventing health problems and counteracting issues with our bird's feet and legs that have already occurred. In order to create a more dynamic living environment we have given the finches the option of two different styles of perch: rigid and twist. When a bird lands on a rigid perch it is completely firm, whereas when a bird lands on a twist perch it flexes causing the bird to jostle into position to maintain its balance. Twist perches force birds to alter their body posture when taking off or landing which also impacts the birds that are already static on the perches as it creates a ripple effect of movement (Law et al, 2010). This increases activity and strengthens the bird's core muscles in order to control their position on the perch. The perching is also set at different height inclines around the cage creating variety, while also allowing the birds to fully utilise as much of the enclosure as possible. In addition, because of the extra space available in the flight aviaries, they are fitted with a wider variety of perch sizes and types, that offer further exercise potential, to the muscles of the feet and claws.

Increased effort when feeding

The zebra finches housed within our facility are fed on a standard regular mixed millet diet and the food has always been provided in dishes on the floor. Zebra finches have a very high metabolic rate and therefore have been fed *ab libitum* as this sufficiently fulfils their energy requirements. With constant access to food however, instances of overweight and inactive birds became more frequent and it was apparent that a different feeding method would need to be incorporated in order to improve the health of the colony. After consideration it was decided that the introduction of hanging millet sprays in the centre of each cage would be the simplest and

most effective technique to combat this issue. Millet sprays are grass seed stems filled with seed that are a popular food source for many avian species. In the wild zebra finches often feed on grass seed heads, showing incredible agility in their feet as they perch on the stems. The millet sprays we use only contain one type of millet, which does not contain all the vitamins and nutrients needed to sustain the birds; however, it does contribute to a balanced healthy diet. A reduced amount of seed is added to the dishes on the floor because of this and the millets are supplied as an additional food source. This provides the birds with the choice of different feeding methods and also helps to prevent the amount of excess seed that is wasted. The millet sprays are hung by using a clothes peg, two Velcro pads and small cable tie (shown in figure 3).

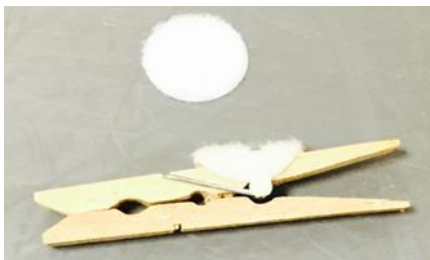


Figure 3 shows the clothes peg and Velcro pad used to attached the millet spray to the roof of the cage

This method is used as the flat surface of the cage ceiling does not allow the millet to be attached in any other way. Hanging the millets in the centre of the cage, out of reach of any of the perches, mimics a natural feeding method and encourages the birds to work harder for their food. To feed from the millet, finches have to grip with their feet using different foot muscles than they would normally use to perch. The muscles used to maintain balance whilst feeding improves the strength and coordination of the bird, making them physically stronger. A foraging opportunity is also offered when providing the millets, as the birds have to harvest their

own seed, which provides mental stimulation as well as increased physical activity.



Figure 2 shows a zebra finch gripping the hanging millet

Access to a bath

Water baths are provided to our finches at Glasgow at a minimum of once a week as part of their routine husbandry. Observations made by the animal house staff have shown that the birds display a range of different behaviours when they are about to be presented with a bath. When other birds within eyesight are being presented with baths an increase in vocalisation and alertness can be seen from individuals and they appear excited knowing they too will soon be given access. This desire to bathe may indicate a strong instinct as their wild counterparts reap many benefits from bathing, making it a crucial part of their lives. Baths play an important role in maintenance by keeping feathers in the best condition possible for as long as possible. While bathing, birds open and close certain feather tracts to expose the spaces between them momentarily, which is then entrapped and squeezed through their feathers to cleanse them. Parasites not only cause irritation on wild finches they also damage the ends of feathers, making them

look slightly sheared or ragged. While preening, birds tidy and repair their feathers, adjusting and aligning each feather in the optimum position. Having access to bathing water encourages birds to preen which also helps to reduce the amounts of parasites on the birds, improving feather health. The flight performance of birds is also said to be increased when water is available for bathing purposes. It has been said that birds that are not able to bathe regularly are clumsier flyers compared with birds that are able to as they are more agile and find it easier to evade predators (Brilot, *et al* 2009). Zebra finches do not have elaborate mating rituals and therefore rely on their bright feathers to attract potential mates. Water access for bathing purposes allows males to clean their colourful feathers, which helps individuals to stand out from the competition as their feathers gleam in the hope of reproducing and passing on their genetic information. The eagerness to bath shows the finches' natural raw instinct and although in captivity they do not need to escape predators or compete for mates, it is easy to understand the drive these birds have to bathe beyond their own enjoyment.



Figure 4 A zebra finch perching on the water bath

Temperature fluctuation

In the wild zebra finches thrive in a range of conditions, from the scorching heat of the day

to the freezing cool temperatures of the evening. Taking these temperature gradients into consideration and in direct contrast to a conventional animal house where a steady day and night temperature is expected to be maintained, for the birds we have engineered into our heating system cooler temperatures for the evening (Law *et al*, 2010). Our temperatures fluctuate between 10-30°C in order to comply with home office guidelines, despite the fact that these birds are able to endure a wider temperature range in their natural environment. The cooler evening environment prompts the birds to fluff up their feathers, which traps air inside the layers, proving insulation. This external signal also causes the finches to congregate on the perches and huddle together for additional warmth. These traits are exhibited by wild zebra finches to allow thermoregulation during the cold nights and also act to reduce the amount of wind on individuals. Decreasing the temperatures in our aviaries in the evening mimics our finches authentic environment and allows them to express behaviours that would be unseen if a consistent day and night temperature was maintained. This minor change has induced behaviours that strengthen group bonding and encourage social interaction while also exposing the birds to an environmental regime that they would encounter in their natural habitat.

Soft set lighting

The lights in our aviaries are on for fourteen hours each day between seven in the morning and nine in the evening. We maintain this daylight cycle throughout the year as it is needed to reduce seasonal changes in our finch's hormone levels as set in the current project licence. This routine is kept constant which gives the birds a rhythm and pattern to their day as they synchronize with fluctuations in the environment. Soft set

lighting is used throughout the bird facility, which slowly fades in and out over a thirty-minute period (Law et al, 2010). For any species of animal it may be distressing for the light to immediately flash on or off. The fading light systems allow the finches' time to comfortably adjust to their surroundings. The gradual changes in light intensity mimic the natural rise and set of the sun, providing the birds with environmental cues that allow them time to rise in the morning and settle in the evening. It has been recorded that birds that roost communally will express unique behaviours as the light starts to fade before eventually turning completely dark. As previously mentioned, communal roosters will gather on the same branch or perch in the evening with the purpose of retaining heat and also in an attempt to evade predators. Individuals farthest away from the centre of the branch or perch will hop over other birds in order to secure a spot closest to the midpoint. This action will repeat itself with more and more birds being pushed from their original spots forcing them to repeat the cycle which will eventually end when the birds settle once the light levels have dropped completely. This behaviour is displayed by the birds in an attempt to reduce their domain of danger assuming a predator generally attacks the closest individual to it.

Night-lights

Maintaining a natural balance of exposure to daylight and darkness is an essential component of sleeping well, however this does not mean animal houses should be completely pitch black at night. There are a lot of positive benefits from keeping a low light source as opposed to complete darkness, leading to the introduction of night lights fitted in the ceiling of each of our aviaries at Glasgow. In a zebra finches natural habitat, light is projected from the moon at night providing a low light source for the birds.

Welfare benefits are provided when using this environmental factor and, given that it occurs naturally in the wild, it is reasonable to assume they would wish to be exposed to this in captivity. Birds do not lie down to sleep. They instead tighten their tendons so that their toes lock around the perch keeping them secure. Some birds can fall from their perch during a deep sleep if they are lifted from the perch or nudged by other birds in the same cage. This would cause their feet to un-flex, loosening their tight grip around the perch surface. Being on the ground alone in darkness is very stressful as they are vulnerable from predation in the wild. A bird's natural instinct in this situation is to automatically fly upwards removing their self from danger and returning to the branch, which can be done safely as the birds are able to see under the moonlight. With no illumination, captive birds can potentially injure themselves as they thrash against the cage walls and mesh in an attempt to reach a perch. The night-lights allow unobscured vision, which eliminates any potential problems for our zebra finches. In an ideal environment, light intensity and temperature fluctuations would be co-ordinated to mimic seasonal changes similar to the natural environment of our zebra finches. However, if these seasonal light and temperature patterns were matched under our current research project it would introduce too many variables which could affect the resulting data. This is an environmental regime that would further help to create a more natural stimulating environment for our bird's and providing it would not interfere with any prospective research projects, it is something that could be incorporated in the near future.

Conclusion

Providing an animal with nutrition and veterinary care is just as important as providing them with an enriched

environment. Keeping an animal in captivity requires careful selection of environmental conditions in order to induce the desired physiology and behaviour. By improving conditions, we are promoting good welfare, which reduces instances of stereotypical behaviour. Stereotypical behaviours are only found in captive animals and are a result of poor psychological wellbeing, which results in repetitive fixed patterns of behaviour with no apparent purpose. Creating a dynamic environment with a range of stimuli for animals to engage with increases brain weight and development making research results fairer and more accurate when being compared with animals that are deprived in their surroundings. Captive environments that are not complex enough to allow animals to perform behaviours essential for reproduction or survival in the wild can have a detrimental effect to research results by reducing validity, reliability and replicability (Garner, 2005). The production of sound research models is an extremely important factor when considering an environmental set up, as is the impact on the welfare of the animal. Environmental enrichment provides purpose for animals and increases their ability to cope with behavioural challenges such as exposure to humans and experimental manipulation. At Glasgow, the steps we have taken to refine our finches' living conditions have contributed to producing physically and psychologically healthier birds, which are now far stronger

research models and act to produce data of the highest quality.

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