Animal Behaviour 103 (2015) 171–177

Contents lists available at ScienceDirect

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav

Commentary

The declining use of animal and behaviour images in animal behaviour journals

Barrett Anthony Klein [a, *], Thomas D. Seeley [b]

[a] Department of Biology, University of Wisconsin – La Crosse, WI, U.S.A.
[b] Department of Neurobiology and Behavior, Cornell University, Ithaca, NY, U.S.A.

ARTICLE INFO

Article history:
Received 10 October 2014
Initial acceptance 3 December 2014
Final acceptance 6 January 2015
Published online
MS. number: AS-14-00807

Keywords:
communicating science
graphics
scientific illustration
scientific visualization
supplementary online information
visual device

It is difficult to overstate the value of images in science. Visualization is often the most effective tool to convey scientific concepts, and the opportunities that come with imaging techniques are growing. Nevertheless, we noticed that recent articles in animal behaviour journals include few images of animals or behaviour. To see whether their numbers have declined, we selected five behaviour journals and collected data from 1114 articles published over the journals' histories. We discovered that graphs (x–y plots) have increased over time, charts and tables have not changed, and images (graphical representations, including photographs, of animals, of behaviour, of animals expressing behaviour and of experimental design) have significantly decreased. To test whether supplementary online information has had effects, we compared the use of visual devices in 75 articles with or without supplementary online information. We found that supplementary online information has added means of visually presenting information, but has not compensated for the decline of images.

Images of animals and behaviours have long played a prominent role in the scientific literature on animal behaviour (Darwin, 1872; von Frisch, 1927; Lorenz & Tinbergen, 1938, Tinbergen, 1951). Early ethologists stressed the importance of making a precise catalogue (ethogram) of what animals actually do as part of making a broad, descriptive reconnaissance of a behavioural subject (Tinbergen, 1953). Words alone are generally inefficient, confusing or biased when describing multicomponent actions unfolding over time and space, so various graphical techniques were used. The logical first choice for depicting behaviour patterns, motion picture film, was expensive and so was rarely used. The early ethologists faced, therefore, the challenge of portraying complicated movements in three-dimensional space as static, two-dimensional images. Tufte (2006, page 32) has called this the problem of translating a 'movie-land graphic' into 'still-land examples'. Brilliant solutions were achieved, as shown by the classic works by Tinbergen (1951, 1960), von Frisch (1937) and Eibl-Eibesfeldt (1970). By using images of animals and behaviour to describe the behaviours under investigation, the early ethologists provided descriptions with many more layers of information than if they had used only words and graphs.

Given the importance of visually describing the behaviour patterns of animals, we became intrigued with how rarely we see images (either photographs or drawings) of animals and behaviour in behaviour journals today. To describe how the use of images in behaviour journals has changed, and to begin to analyse why it has, we investigated the use of visual information in animal behaviour papers during the past 77 years, and we tested the hypothesis that the advent of supplementary online information (SOI) has influenced the changes that we found. We predicted that if images remain as important to scientists and journals in the present as they have been in the past, and if the number of images per article has declined, then SOI has compensated for this by including additional images.

METHODS

We surveyed papers published by five behaviour journals: *Ethology* (formerly *Zeitschrift für Tierpsychologie*), *Behaviour, Animal Behaviour* (formerly *The British Journal of Animal Behaviour*), *Behavioral Ecology and Sociobiology* and *Behavioral Ecology*, recording data on the use of visual devices in each journal over the course of its history. We recorded a total of 8735 figures and tables in 1114 articles by sampling 20 articles per year every 5 years. The journals are the same five as used by Price, Clapp, and Omland

* Correspondence: B. A. Klein, 1725 State Street, University of Wisconsin – La Crosse, La Crosse, WI 54601, U.S.A.
E-mail address: barrett@pupating.org (B. A. Klein).

http://dx.doi.org/10.1016/j.anbehav.2015.02.004
0003-3472/

(2011) in their analysis of declining use of phylogenies in animal behaviour journals. We focused on papers representing original research and did not collect data from editorials, book reviews, symposium abstracts or reports on 'featured articles' because these contributions were unlikely to include data or visual devices related to research.

Various visual categorization and taxonomic schemes exist (Briscoe, 1990; Cleveland, 1993; Wright, 2007). We categorized visual devices into images (Fig. 1), graphs, charts and tables, with seven subject categories of images and eight types of graphs (Table 1, Supplementary Fig. S1). For the purposes of our study, we treated a single video clip as an image. Like photographs and videos, drawings are images, but drawings are considered here as rendered interpretations of a subject (e.g. schematic in pen and ink, realistic painting, digitally manipulated photograph, computer-rendered illustration). See Supplementary Material for additional details.

Twenty articles were randomly selected (www.randomizer.org, choosing a sequence of issue numbers) from a journal in its first year, the closest subsequent year ending with 5 or 0, followed by every fifth year, ending with 2010 (see Fig. 2). By selecting from years ending with 5 and 0, we compared effects across journals for identical years. All journals except *Behavioral Ecology* (1990) premiered during interim years (1937, 1948, 1953, 1976), so data from these years were excluded from global analyses, but were included in within-journal analyses. *Ethology* did not publish articles from 1944 to 1948, so between the years 1940 and 1950, we sampled from the year 1943. When a journal did not publish 20 articles within a sampled year, we sampled from the issue(s) closest in publication date to this year ($N = 19$ articles; *Ethology*: eight articles in 1941 (six articles for 1940, two articles for 1943) and one article in 1951; *Behaviour*: six articles in 1951 and three articles in 1956; *Behavioral Ecology and Sociobiology*: one article in 1977 (for premiere year 1976)). *Behaviour* published only 14 articles in its

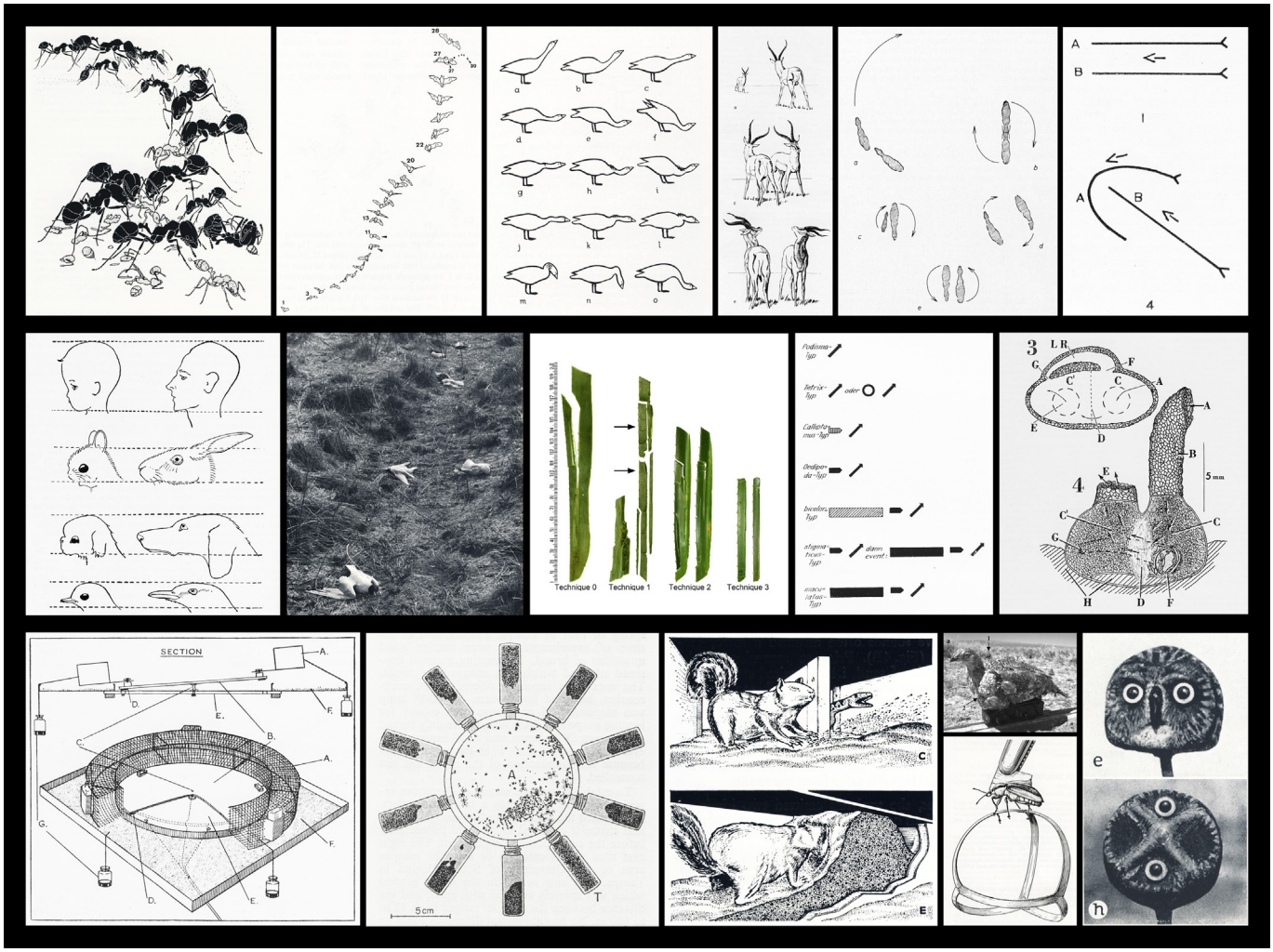

Figure 1. Composite of images from behaviour journals. Top row, from left to right: animals expressing behaviour, including ants defending their colony (Wilson, 1976; reprinted with permission: Wilson, Springer); a bat pursuing prey (coupled in the original figure with echolocation sequence; Kalko, 1995; reprinted with permission: Elsevier); threatening goose gestures (Fischer, 1965; reprinted with permission: J. Wiley); two illustration techniques (a drawing and a schematic) depicting ungulate behaviours (Walther, 1965; reprinted with permission: J. Wiley); and a schematic of fighting female trout (Jones & Ball, 1954; reprinted with permission: Elsevier). Middle row: animal and behaviour, uncoupled. Animal: infantile and adult animals (Lorenz, 1943; reprinted with permission: J. Wiley). Behaviour: the tell-tale corpse-laden trail left by a red fox (Tinbergen, 1965; reprinted with permission: J. Wiley); plants used as crow tools (Holzhaider, Hunt, & Gray, 2010; reprinted with permission: Holzhaider); schematized grasshopper call components (Jacobs, 1950; reprinted with permission: J. Wiley); and a larval caddisfly case (Wallace & Sherberger, 1975; reprinted with permission: Elsevier). Bottom row: experimental design. Rat chamber without animal (Eayrs, 1954; reprinted with permission: Elsevier); olfactometer with ants (Hangartner, Reichson, & Wilson, 1970; reprinted with permission: Elsevier); arena featuring antisnake behaviour by ground squirrel (Coss & Owings, 1978; reprinted with permission: J. Wiley); robotic sage grouse without animal (Patricelli & Krakauer, 2009; reprinted with permission: Patricelli); Y-maze globe with beetle (Hassenstein, 1959; reprinted with permission: Elsevier); and artificial predators without animal (Curio, 1969; reprinted with permission: J. Wiley). Many of the figures were cropped from original source and most scanned images were adjusted for saturation, brightness and contrast.