

# Establishing a research field in natural sciences

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Three case studies



**Animal Ethics**

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# Executive summary

## Background

Getting detailed knowledge about the problems that different causes address, including those concerning animal advocacy work, can be crucial for those causes to successfully achieve their goals. This knowledge, however, may not be available, and novel research is sometimes needed to gain it. In comparison to just doing independent research, promoting the creation of a new academic field can maximize the resources available for such research in the long term, the expected quality and quantity of the research that may end up being produced, the impact in practice and policy making that such research can have and its potential to drive a scientific and normative shift. Furthermore, this avoids the risk of the research being discredited as a result of being performed independently of academia. This study seeks to gain more knowledge about how new disciplines emerge in order to provide guidance for advocates working within newly formed cause areas which require such developments.

## Objectives

This study aims to provide ideas about actions that both researchers inside academia and other agents outside academia can take to promote the early growth of new academic fields. It also aims to learn more about the obstacles that those attempting to create new academic fields may face, how to overcome them, and the possible mistakes that can be made in doing so.

## Methodology

To get a better understanding of this problem, we analyzed three research fields in the life sciences which were established relatively recently and which incorporate both positive and normative analysis: animal welfare science, conservation biology, and

cognitive ethology. We reviewed the literature considered to be the basis of early development in each field, and the literature reviewing its history. We also interviewed scholars knowledgeable of the development of each of these fields, which we identified according to their publication history, citation count, and general standing in relation to other authors in the field, as well as with their role in the development of the field, and of how well placed they are to understand it.

## Animal welfare science

Animal welfare science was created as a result of public funding being invested in the field. What caused this was the growth of concern about the topic among the general public, especially in Europe and especially in the UK, where, in the 60s, Ruth Harrison's book *Animal machines* raised awareness about the situation of animals in factory farms. There was little prior interest among veterinary scientists and other scientists in this topic, although that progressively changed as the field developed. Between the 1970s and the 1990s several relevant publications were published that helped to shape the field, and some journals were created where animal welfare researchers were able to publish their work. Scientists with different backgrounds worked together to develop a common conceptual framework to assess something that is hard to measure objectively, welfare. What made this possible despite the initial lack of interest among scientists was political action, which both led to the provision of funding and to the introduction of legislation and public policies about the conditions in which animals should be kept. This provided opportunities for work for scientists working in animal welfare. Some independent animal organizations also provided funding and support to research in this field.

## Conservation biology

Work in conservation biology had several relevant pioneers, but it can be said that it started as such in the 60s, triggered by the interest in the issue among some ecologists and the public. Legislation about conservation approved from then on has promoted research in this field. In addition, public support for conservationist goals grew significantly during that period, which helped private organizations supporting these goals to have much more resources. The field was established after two large conferences took place in the late 70s and early 80s. The Society for Conservation Biology, its journal

and several books have been very influential in promoting work in the field and pointing out several key problems for conservation biologists to work on. Interdisciplinarity here, rather than being a challenge, has provided many opportunities for work in this field to be done from different approaches. Today conservation biology is a very prominent discipline. The development of the field was possible thanks to the work of a group of dedicated biologists, but also, and crucially, by the continuous support of external agents. These agents included private organizations with conservationist aims. In addition to putting pressure on legislators and governments to introduce new legislation and public policies that provided opportunities to work to conservation biologists, these organizations directly funded all the relevant efforts done by scientists to create the field.

## Cognitive ethology

Unlike animal welfare science and conservation biology, cognitive ethology has not been promoted or supported from outside academia, rather its development was the result of the interest of a relatively small number of scientists. It has not been as successful as conservation biology and animal welfare science, and it remains a small field that is little known by the public. However, it has permeated the work of scientists in cognitive sciences and in other disciplines, which are now much more open to attributing minds to nonhuman animals. Initially it was presented as a field not committed to a normative approach in order to avoid controversy, though that has changed in recent decades. This, however, has likely contributed to animal advocates not recognizing the field as a relevant one for their work, and so animal organizations haven't funded research in the field. As a result, scientists working in this field have only had access to funding through the more usual academic channels. This has meant that this field has not had the same opportunities for growth as the others.

## Lessons for establishing a new field of research

In light of the results of the three case studies there are some lessons that can be learned about what scientists and external agents can do to promote the early growth of a new field.

We saw that actions like the organization of conferences, the establishment of influential professional organizations, the creation of specialized journals, and the

organization of training programs were very important ones in the case of at least some of the fields we examined. However, they may be unfeasible at very early stages when there are just not enough scholars interested in the field. Getting support from senior scientists can also be very helpful, but may not be possible. Individual scientists can nevertheless try to influence others by trying to publish their research in well-respected journals, in addition to conducting seminars and engaging in personal communication. They can work on developing a clear conceptual framework. When other researchers become more interested in this issue, they can try organizing activities, opening courses and publishing books.

As for external supporters of the field, they can provide grants to researchers and fund small projects or minor events like seminars or small conferences. They can also help to put scientists interested in the area in contact with one another. At some point they can also fund small training programs to interested scientists or students. In addition to this, their work can be important in raising awareness among the general public, which may indirectly spark support for the field, and do lobby work which can help to channel public funding to do more research in it.

## Conclusions

We found it difficult to draw clear generalizations from the history of previously established fields, as there are many factors influencing new disciplines in different directions, which can depend crucially on circumstances external to academia. Also, the section about the lessons for establishing a new field shows that many of the actions that appear to have played an important role are relatively common sense ones which we would have already expected to work before doing this study. Beyond this, we gained some insights that may be useful to keep in mind in developing a new field. Among them, we have also seen that while openly stating the normative commitments of the field may mean dismissive reactions by peers, it can also make it easier to get support from outside academia. For their part, external agents who want to support the creation of new fields of research should have good knowledge of the actual status of the field to decide how to proceed



# Background

For causes like animal advocacy progress, those involved must know enough about the problems they face to be able to devise strategies to overcome them. Sometimes this knowledge can be found within existing bodies of published research, in which case efforts can be focused on piecing together information to develop effective solutions to such problems. Other times this information is not readily available and must be discovered, which is often the case for new and emerging cause areas that do not fit within the boundaries of traditional research paradigms. This may prompt the development of new fields of research designed to target such areas of knowledge.

Establishing a new field of research under these conditions presents all kinds of unique challenges and difficulties those involved must overcome. For instance, it requires a substantial allocation of resources which are often limited to new cause areas. Prioritizing the development of a new field thus entails the opportunity cost of not being able to invest resources into other useful activities, such as publicity to make the cause better known and attract more people. Resources could also be used to finance independent research directly, making the establishment of a new field unnecessary.

However, there are strong reasons for working to develop a new research field, primarily stemming from recognition within academia. The general perception of academic research is that it is of higher quality and closer to being 'objective' than research funded by independent institutions. Below, we have included a summary of the reasons to promote academic research in order to advance work within a particular field, ordered from what we understand to be least to most important:

## *(1) Long term maximization of available resources*

While independent organizations can finance research that might contribute substantially toward their cause area, many of these groups are not for profit and rely on public funding to support their work. While cost-effective in the short-term, this model depends on continued support from outside parties and is not so stable in the long-term. If the problems to be addressed are very complex, then it might be preferable for

advocates of new and complex cause areas to invest resources into promoting research from within established institutions (e.g., academia) to provide better support for researchers to continue working on difficult projects over long periods of time.

*(2) Expected quality and quantity of research*

Academics can choose to dedicate a large part of their careers to doing specialized research. They also often have the freedom to choose *what* they research throughout their careers, allowing them to make significant progress on issues which they consider important. This time and focus allow them to specialize, developing the skills and expertise to consistently produce high quality research from within their field. In addition, academic institutions often provide affiliated researchers with the requisite infrastructure, tools, and equipment for conducting specialized research projects. Academics are also very well-positioned to influence the research of their peers (by establishing working relationships, attending conferences, publishing in respected journals, etc.), and resultingly, the fields which they themselves work within. For these reasons it is likely that the quality and quantity of research produced by the academic sector exceeds that of independent organizations.

*(3) Impact in practice and policy making*

Policy makers generally consider research published by academics to be more reliable and credible than that of independent researchers. Politicians and other state actors typically seek to inform their decision making by consulting the work of established scientists and academics who are seen as authorities in their respective fields. The same holds for other public figures who are likely to take the claims of scientists more seriously than those made by advocates of a cause. As such, we can expect that the impact of academic research on practical affairs will be greater than independently produced research.

*(4) Potential to drive a scientific and normative shift*

As noted in point (2), academics working on problems within established fields are better able to influence the research of their peers than external figures such as advocacy groups who have little perceived authority. Independent research does exert some degree of

influence on the course of mainstream academic research; however, for various different reasons (e.g., self-publication, lack of official recognition, self-managed peer review) it is perceived to be inferior. As a result, many academics are skeptical of the credibility of independent, non-affiliated sources and are discouraged from citing it in their own work, which as we will see below can lead to discredit.

A second relevant point is that when a field becomes well-established within academia it can be incorporated in curricula at universities and other educational institutions. This is especially important for the long term viability of a new research field as it exposes students to problems within that area and teaches them the skills to address them. Moreover, if there is a normative component to these problems, their inclusion within educational programs also serves to introduce students to new values which have the potential to change their perception of future problems which they might encounter during the course of their own future research. Conducting value-laden research also has the potential to influence society on a political and public level (Flood et al., 2013).

#### (5) *Avoiding the risk of discredit*

If a new research field is established outside of the academic system, it faces serious risks, especially if it includes normative components that aren't widely accepted by academics (this is the case for many altruistic causes that are not considered mainstream). For example, policy makers might attempt to deny the legitimacy of such research if it is not backed by recognized scientists. Policy makers are more likely to trust the judgement of recognized scientists than that of advocacy groups or independent researchers. Similarly, members of the public presented with evidence that they should adopt lifestyle changes might reject this evidence if they can find reasons to doubt its legitimacy. This does not mean that all causes need to be supported by sound science in order to succeed; however, even with sound science that helps establish a new cause, a lack of scientific support can undermine its credibility.

Among scientists, research published outside academia lacks this perceived credibility and so is very easy to disregard or discredit. Studies that have not undergone formal peer review within an established journal are considered less reliable sources *even if* the quality of their study design or argumentative structure is similar. In addition, when potential fields of research are excluded from the academic mainstream, they risk being stigmatized. If perceived figures of authority (for example, prominent scientists) openly reject such research or tacitly ignore the significance of its findings, the

development of fields which cultivate this research will be hampered. In worst case scenarios, they might be considered pseudoscientific and lose all of their perceived credibility among mainstream audiences, considerably reducing their potential to enact change for whatever cause they promote. Repairing this damage might take years or even decades — if it is even possible — damaging the cause itself in a permanent and irreversible way.

Considered together, these challenges present a strong case for addressing problems faced by new cause areas within the academic research system. The difficulties involved in successfully establishing new research fields within academia may vary with the scale, complexity, and difficulty of the problems being addressed. A relatively minor problem could be solved by the efforts of few academics within a discipline, while a larger problem containing numerous smaller problems that transcends pre-existing fields of research might require the establishment of its own field.

This task of creating a new academic discipline might seem like a daunting and ambitious project to undertake — especially when we think of traditional and well-established subjects such as mathematics, biology, and philosophy, which have achieved a high level of cultural authority and legitimacy in the centuries since their emergence. However, over the course of the last century, especially during the last few decades, there has been an emergence of a wide range of fields of inquiry, many of which have gained enough acceptance and support to be institutionalized and recognized as distinct disciplines (Klein, 2017, p. 21). These studies are now taught at many research and educational institutions, and are widely supported by colleagues in other fields, funding agencies, prospective students, and potential employers (Jacobs, 2017, p. 36).

Some of the new academic disciplines that have risen to prominence in recent decades were motivated by moral concern, resulting in their integration of normative views. This is evident in the case of fields that explicitly address normative concepts such as bioethics (in addition to various other fields in applied ethics) and animal ethics — after which our organization is named. Other examples of these new normative fields include normative decision theory or social choice theory. but fields that are primarily positive (descriptive, explicative, or predictive) in their research methods might also have implicit normative components. These include fields as diverse as gender studies, development economics, welfare economics, social work, science and technology studies, animal studies, and conservation biology, among many others. All these fields were created in response to practical problems which they aim to solve, which reflects the topic

of this report — altruistic causes which require more research to be able to effectively promote positive change in the world. And the success of their establishment shows that it is indeed possible for serious causes to trigger such academic developments.

# Objectives

- Find out which actions by academics and researchers might help to promote the early growth of new academic fields
- Learn more about which actions by agents from outside academia can help to promote the early growth of new academic fields
- Learn more about the difficulties and challenges involved in creating new academic fields, how these might be overcome, and learn to recognise and avoid possible mistakes involved in this process.

# Methodology

## The selection of the cases to study

In order to increase our understanding of how research fields grow and what kind of strategies can be employed to establish a new one, we decided to analyze three research fields.

To decide which fields to choose, we considered the following three factors:

- A. *The recency of their establishment.* According to this metric, a younger field scores higher than an older field because the circumstances under which it became established have more in common with current circumstances. We considered this relevant because we want to learn more about how scientific fields can be created in the present day.
- B. *Similarity to life science disciplines.* Because the focus of Animal Ethics is on helping nonhuman animals, we chose to focus on research fields in the natural sciences (although we believe that many of them will also be applicable to new fields of scientific research in other cause areas). Accordingly, commonalities and differences between candidate fields were determined with reference to two academic classification systems; knowledge codification<sup>1</sup> and knowledge consensus.<sup>2</sup>
- C. *Use of positive and normative analysis.* Fields incorporating both positive and normative analysis in their research scored higher in this category than fields focusing on only one of these elements.

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<sup>1</sup> Defined as the extent to which knowledge can be consolidated or codified into succinct and interdependent theoretical formulations..

<sup>2</sup> Defined as the unity of mind between researchers on elements of social structure and practice within their field. Scientists operating from the life sciences tend to share the same conceptual framework while conducting their research, so preference was given to studying fields scoring higher in this category.

In accordance with the first criterion, we did a preliminary analysis of ten different academic fields that were founded in recent decades, making use of literature reviews, historical accounts, meta-analysis, and other relevant forms of evidence to inform our understanding. These fields were: animal welfare science, behavioral ecology, cognitive ethology, community ecology, conservation biology, environmental economics, environmental ethics, evolutionary ecology, experimental philosophy, and population ecology. We then considered whether these different fields met the other two criteria. While in some cases there is room for disagreement, we came to the following conclusions:

	<b>Life sciences</b>	<b>Positive and normative analysis</b>
<i>Animal welfare science</i>	Yes	Yes
<i>Behavioral ecology</i>	Yes	Not normative
<i>Cognitive ethology</i>	Yes	Not completely clear
<i>Conservation biology</i>	Yes	Yes
<i>Community ecology</i>	Yes	Not normative
<i>Environmental economics</i>	No, even if based on results from it	Yes
<i>Environmental ethics</i>	No, even if based on results from it	Not positive
<i>Evolutionary ecology</i>	Yes	Not normative
<i>Experimental philosophy</i>	No	Its normativity is contended
<i>Population ecology</i>	Yes	Not normative

According to the outcome of this assessment, we considered animal welfare science and conservation biology to be the most suitable fields for our analysis, because they were the only ones to clearly meet all three conditions. Among the remaining fields, cognitive ethology was chosen mainly because of its focus on animals. While cognitive ethology is not an explicitly normative field of research, those working on it are openly moved by a



moral concern for the well-being of animals, and a key part of its subject matter — consciousness — is especially relevant to normative considerations.

An extra reason to consider these three disciplines is that they both emerged by combining the knowledge gathered in other preexisting fields. In fact this is a common way in which new disciplines are formed: by engaging in research combining contributions from different disciplines, both with regards to methods and bodies of knowledge. Burggren et al. (2017, pp. 101-102) suggest that the biological sciences, like other fields, are constantly subjected to “the interdisciplinary cycle”. This happens when one established discipline is influenced by the ideas and techniques of other disciplines, resulting either in a fleeting field or in a merger of two disciplines, which then can in turn be incorporated in other new emerging fields.<sup>3</sup> This has happened in the case of animal welfare science and cognitive ethology, and even to a larger scale in the case of conservation biology.

Finally, another advantage of these choices is that each of the three selected fields have achieved variable degrees of success, giving us insight into the effectiveness of their different strategies.

Conservation biology has become a very important field within academia, in public policy decisions, and in the public consciousness. It has also been very successful in permeating other related fields, reflected in the growing number of articles addressing conservation issues being published in general science journals (e.g. *Science* and *Nature*) and specialized journals in ecology and resource management. The influence of conservation biology has also been significant in land use and urban planning, design, landscape architecture, agriculture, and in particular, marine and freshwater biology, where a new research field “marine conservation biology” has emerged. Beyond academia, conservation biology research has helped to inform practical conservationist policies and legislation on a global scale, and granted prestige to conservationist efforts.

Animal welfare science has also experienced considerable success in its efforts, playing an important role in the development of policy concerning animal welfare and being integrated into the teaching curricula of veterinary schools across the world. It has

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<sup>3</sup> This can happen in different ways and at different levels of integration. *Multidisciplinary* work, is the more basic one, which incorporates research done by scientists working in different disciplines. More integration occurs with *interdisciplinary* work, which incorporates the approaches and methods from different disciplines, and with *cross-disciplinary* work incorporates the approach of a certain discipline within another one. *Transdisciplinary* work occurs, finally, when cross- or interdisciplinary work eventually gives rise to a new paradigm, with its own methods and approach.

informed policy and legislation concerning animals being kept under husbandry conditions, in addition to many other sectors such as wildlife management, medicine, and experimental research involving live animal subjects. Large scale examples of animal welfare science's influence include several European Union directives, as well as regulations accepted by the World Organization for Animal Health.

Cognitive ethology differs from the other two case studies analyzed in this report since it has not been formally established to the same extent, nor has it received such widespread recognition. However, the field has achieved success in furthering the study of animal minds within the sciences by helping to promote the serious study of animal mental states. It has also had a notable impact on the works of philosophers and ethicists whose work concerns animal sentience and welfare (Allen & Bekoff, 2007, p. 315). Moreover, studies attributing cognitive mental states to animals have gained a lot of attention in the mainstream media and are popular in television documentaries and the science sections of newspapers and magazines.

The reasons given above are enough for us to consider these three disciplines the best examples for our study of how different fields in the life sciences have evolved in recent decades.

## Methods and interviewees

In our analysis of these case studies, we reviewed the literature that was considered foundational to each field's early development, as well as that which provided commentary on its history. To further inform our understanding of the establishment and development of these fields, we also conducted interviews with leading academics and incorporated their perspectives into our analysis.

To select our interviewees, we identified experts in each of the selected fields. We chose them taking into account their publication history, citation count, and general standing in relation to other authors in the field. We also considered their role in the development of the field, or how well placed they are to understand it.<sup>4</sup> We contacted sixteen experts, and received eight positive responses, four declines, and four non-responses. Participating individuals were:

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<sup>4</sup> For example, one of the scientists we interviewed both worked directly in animal welfare science research and holds a key role in the Universities Federation for Animal Welfare (UFAW), an organization dedicated to promoting it. especially well placed to understand the development of the field.

<b>Research Field</b>	<b>Name</b>
<i>Animal Welfare Science</i>	Donald Broom
	Emily Patterson-Kane
	Stephen Wickens
<i>Conservation Biology</i>	Bruce Wilcox
<i>Cognitive Ethology</i>	Colin Allen
	Marc Bekoff
	Dale Jamieson
	Carolyn Ristau

We conducted a total of seven semi-structured interviews, based on a protocol that included a set of discipline-specific questions. Each interview lasted approximately 45 minutes, and relevant parts have been included in this report with the prior consent of interviewees. Our questions focused on understanding the key elements in the early development of each field which supported their establishment within the sciences. We also asked questions about specific challenges restricting their growth and how they overcame them, as well as the role that external agents and funding had on early field growth.

## Case study structure

To communicate the findings of our literature review and interviews with authorities in each field, we chose to organize each case study into three sections as follows: a description of the general process that led to the formation of the field, a description of some of the challenges for the development of the field, and an account of the role that external agents — that is, agents who were not academics but were involved in the development of the field — may have had in its creation.

# Animal welfare science

## Emergence of animal welfare science

Animal welfare science is, as the name suggests, a research field that aims to scientifically study the welfare of animals with respect to positive and negative conditions which they face under the management of humans. Although concern for animal welfare has received some attention by scholars in the past, its pursuit as a field of scientific inquiry only began in the latter half of the 20th century in response to a growing trend of industrialised farming practices involving animals (Mellor et al., 2009, p.vii; Fraser, 2008, p. 5). Reactions against these practices eventually made them the subject of public concern and debate in several countries (mainly in Northern Europe and English-speaking countries), initiating a cultural shift that grew to define the second half of that century. Throughout this period, the field of animal welfare science began to take shape as an institutional response to public concern about the treatment of animals, as well as a driver of legal reforms.

The first organization created to address this issue was the Universities Federation for Animal Welfare (UFAW), founded in 1926 (Haynes, 2008, p. xii). One of the key agents in bringing this about was Major C. W. Hume, reportedly the first to use the expression “animal welfare” (Haynes, 2008, p. 7). Despite this early start, the next significant step in the field’s development came many decades later in 1964 when Ruth Harrison, a British animal advocate, published *Animal Machines*. This book had a great impact on public attitudes, raising concern for the welfare of farmed animals in production systems, and stirring normative debate about if, and under which conditions, the use of animals as resources is justified (Fraser, 2008, p. 61).<sup>5</sup> Moreover, it was likely the first prominent

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<sup>5</sup> This book was followed by others about the moral consideration of animals that challenged views about the moral consideration of animals more deeply, including Godlovitch, Godlovitch and Harris’s *Animals, men, and morals* in 1971 and Singer’s *Animal Liberation* in 1975. Before that, shortly after the publication of *Animal machines*, another publication that got much attention among part of the British public was Brigid Brophy’s article “The Rights of Animals”, published in *The Sunday Times* in 1965.

piece of writing to openly describe the ways in which animals were being exploited on factory farms.

In the years following its publication *Animal Machines* achieved substantial success, helping introduce important themes that would become recurrent in future publications and media coverage of animal industries (such as the role of welfare in systems designed to maximize efficiency and profit) (Fraser, 2008, p. 63). The book drew attention to factory farming as a moral issue, altering the public's perception of the situation of animals (Sayer, 2013). Collectively these changes helped generate political pressure in the UK to formally address the welfare of farmed animals (Fraser, 2008, p. 61; Walker et al., 2014, p. 80).

Public outcry in response to the book's publication prompted the British Government to form the Brambell Committee, a group of experts from various animal-related sectors such as zoology, veterinary, and agricultural science, named after E. Rogers Brambell, a professor who was given responsibility for organizing the committee. One of the members of the committee, ethologist William H. Thorpe, insisted on the observation of the behavior of animals as a way of examining their wellbeing, which later became a key method in animal welfare science. In 1965 the committee published the Brambell report. Today, this report, the committee that produced it, and the actions of its members, are widely recognised for being influential to the early growth of the science of animal welfare.<sup>6</sup>

Public pressure, together with the results of the Brambell report, led the British government to adopt new regulations for the use of animals (FAWC, 2009, p. 6). This included a provision of funding for the study of animal sentience and welfare, setting a precedent for governments of other countries to make similar decisions regarding animals (Fraser, 2008, p. 65). Also as a direct result of the Brambell report, a new official body — the Farm Animal Welfare Advisory Committee (FAWAC) — was established in 1965 (it was succeeded by the Farm Animal Welfare Council (FAWC), in 1979, and in 2011 was renamed Animal Welfare Committee (AWC)).

In 1966, the Society for Veterinary Ethology was created in Scotland — later renamed the International Society for Applied Ethology (ISAE) (Petherick & Duncan, 1991, p. 16). Its membership grew significantly in the following decades. Aside from providing a forum for discussion between ethologists that were interested in incorporating welfare concepts into their research, the society founded the journal *Applied Animal Biology* in

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<sup>6</sup> Haynes (2008, p. xii) says: "The report was taken as a mandate for animal scientists to undertake a study of animal welfare, and self-styled animal welfare scientists tend to trace their origins to this mandate."

1974 (later renamed *Applied Animal Behaviour Science*). This was later described as “the most important journal for scientific papers on animal welfare” by Donald Broom — the world’s first holder of an academic chair in animal welfare science, whose PhD supervisor was Thorpe (Broom, 2011, p. 126).

In 1972, the RSPCA created scientific advisory committees on farm, laboratory, and wild animal welfare (Haynes, 2008, p. 3). The efforts of these committees, in addition to the funding they provided for scientists to conduct research, has been said to have “helped to trigger a new field of scientific study”; namely, animal welfare science (Ryder, 1998, p. 55; Haynes, 2008, p. 10). Further, in the 1980s the RSPCA “established its own in-house scientific departments” (Ryder, 1998, p. 55), and began publishing its own *Science Review* in 1991 (Haynes, 2008, p. 71).

While these developments were taking place within the UK, increased consideration for the welfare of animals was spreading rapidly throughout other European countries and, importantly, the European Union. Since the 1970s, the EU approved several pieces of legislation incorporating concern for the welfare of animals used in farms, experimental procedures, transport, and other areas (Fraser, 2008, pp. 219-220). These directives are binding on all EU countries, which must adjust their own legislation in order to match them. In order to inform the content of this legislation, and to ensure compliance, research and training within the field of animal welfare science received further support. In addition, the EU created the Council of Europe Standing Committee of the European Convention for the Protection of Animals kept for Farming Purposes, which also requires advice from experts, although the number of animal welfare scientists whose work has been required by this body has been much smaller.

During the 1950’s in the USA, several animal welfare organizations were created (e.g., the Animal Welfare Institute and the Humane Society of the United States). These groups supported the passing of legislation regulating animal exploitation practices, such as the 1958 Humane Methods of Slaughter Act. In the early 1960s, the issue of the kidnapping of dogs for use in animal experimentation was exposed and raised concern among the general public in the USA. This led to an increased interest in ethical questions concerning the use of animals in industry, ultimately resulting the 1966 Animal Welfare Act being passed. In subsequent years, other laws related to the protection of animals, such as the Horse Protection Act in 1970, were also passed. While these laws somewhat increased the attention given to the question animal welfare in academia, the extent to which they did so was considerably lesser than in the UK and the European Union. As such, the role that the USA played in the early development of animal welfare science was limited.

The Animal Welfare Act was revised in 1985, but remained extremely limited in terms of protecting animals and promoting the study of their wellbeing (for one thing,

only some vertebrates were covered by the act — rodents for example were excluded). This revision did require that institutions conducting animal experiments had their procedures examined by an Institutional Animal Care and Use Committee (IACUC), but it is not clear that these committees had a substantial impact on the development of animal welfare science during this time period.

During the 1980s and 1990s, the field of animal welfare science experienced significant growth — particularly in Europe, where regulations on the use of animals in industry were most strict. The number of publications concerning animal welfare sharply increased, and a number of specialist authors within this field began to grow. Among these figures were Donald Broom and Marian Stamp Dawkins.<sup>7</sup> Broom wrote several highly cited papers, in addition to his 1981 book *Biology of Behaviour: Mechanisms, Functions and Applications* which was widely regarded. In 1980, Dawkins published the book *Animal suffering: The Science of Animal Welfare* which helped shift the discourse in animal welfare science towards one in which the feelings of the animals were of central concern. Prior to this publication the feelings of animals were by and large neglected by animal welfare scientists, which was perhaps due to the pervasive influence of philosophical behaviorism during the early-to-mid 20<sup>th</sup> century (Duncan, 2006, p. 13-14).

Ian Duncan was another important figure in this field who in 1995 was appointed to the first Chair in Animal Welfare in North America at the University of Guelph. Throughout the 1980s, several other North American authors began publishing work in animal welfare science that helped aid its development outside of Europe. These included David Fraser, a Canadian trained in Scotland, and Bernard Rollin, a professor of philosophy, animal science, and biomedical science in Colorado.

As the field continued to grow and attract interest, the 1990s saw the creation of new academic journals; these included *Animal Welfare*, which was founded in 1992 by the Universities Federation for Animal Welfare (UFAW), and the *Journal of Applied Animal Welfare Science* in 1998. By providing a medium for the publication of animal welfare research, these journals facilitated the field's development into the 21<sup>st</sup> century. Utilising knowledge produced through decades of study in other established animal-centred disciplines (for example, the behavioral, physiological, and veterinary sciences), animal welfare scientists began to apply established methodologies to their own research. This encouraged the development of innovative new methodologies and research frameworks within the field itself, further increasing its credibility as an independent scientific discipline (Mellor et al., 2009, p. VII).

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<sup>7</sup> Although Dawkins has continued to study the welfare of animals, she has now backed away from her initial views on the study of the mental states of nonhuman animals (see Dawkins 2017).

Before the specialist animal welfare science journals were created, articles were published in the journals of related fields including ethology, veterinary science, cognitive science, and human animal interactions, among others. Doing rigorous and quantitative research and getting it published in top journals was important in gaining respectability for the field, which otherwise might have been seen as unscientific. It was likewise important that the new journals that were created for the discipline adopted very high standards (Donald Broom, interview proceedings).

By the late '80s and early '90s, the field of animal welfare science had already established its own research niche and became widely recognized as a legitimate field of scientific inquiry. The Universities Federation for Animal Welfare (UFAW) organized conferences and other meetings centered around animal welfare. Such events and similar ones organised by the ISAE helped to build relationships between researchers working on this topic, and helped the field to be seen as a distinct area of study (Stephen Wickens, interview proceedings). In addition, since 2004, the World Organization for Animal Health (OIE) has adopted a set of “animal welfare standards,” which have since been revised and incorporated in the Terrestrial Animal Health Code (OIE 2019a) and the Aquatic Animal Health Code (OIE 2019b).

In the following years, the field has been described as having “emerged as a recognized discipline with dedicated degree courses, textbooks, journals, research departments and specialists” (Mellor et al., 2009, p. VII). An analysis of publications trends in animal welfare notes a 10-15% increase per year from 1993 to 2012 — three times the average rate of growth experienced by other scientific fields assessed (Walker et al., 2014, p. 82).<sup>8</sup>

## Challenges

A great difficulty faced by animal welfare scientists was, and remains, the perception that empirical studies involving concepts with normative significance (i.e., welfare) are not truly scientific. Because of its origin in public ethical concern over animal treatment, animal welfare science has been described as a “mandated field”, in the sense that it seeks

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<sup>8</sup> Because of animal welfare science’s focus on the treatment of animals directly used by humans, it has had little impact on wild animals (for exceptions see Kirkwood et al., 1994; Jordan, 2005; Kirkwood, 2013; JWD Wildlife Welfare Supplement Editorial Board, 2016; Beausoleil et al., 2018; Brakes, 2019). An analysis of publication trends within the field affirms this research bias; animals kept in farms are studied more than other animal groups (Walker et al., 2014, p. 86), and animals in the wild are seriously disregarded (Animal Ethics 2020).



to “mandate” research aimed at exploring those concerns and is actively involved in interventions formulated in response to them (Fraser, 2008, p. 8). Many in the discipline, such as the Universities Federation for Animal Welfare (UFAW), have attempted to downplay the normative commitments of the discipline by sharply distinguishing it from animal rights views, antispeciesism, and other forms of ethical opposition to the use of animals as resources (Stephen Wickens, interview proceedings). Previously described methodological considerations linking animal welfare science to other recognised scientific fields were also important for it to gain credibility and respect within the life sciences (Emily Patterson-Kane, interview proceedings).

Another challenge for the field to overcome was a widespread skepticism of mental states as legitimate objects of scientific inquiry. This may have been due to philosophical difficulties regarding research on knowing other minds, which was seen to “muddy” the waters of objective empirical science. For similar reasons to this, psychiatry was considered less respectable than other areas of medicine at the time. Given this, it is hardly surprising that nonhuman animals, whose modes of communication are far less direct and intuitive to grasp (for members of our own species), were widely excluded from consideration in research (Donald Broom, interview proceedings). In addition, many scientists also had a vested interest in not treating animal welfare science as a serious scientific discipline because they feared that it might make it more difficult for them to do other forms of research on animals (Donald Broom, interview proceedings). Few others held the view that animals cannot have any levels of welfare or wellbeing as they are not sentient beings. This denialism, however, has been progressively challenged (Low et al. 2012).

Animal welfare science has achieved some success in countering these challenges by forming journals, textbooks, courses, and academic degrees, and certifications centered around the study of animal welfare, and by placing a research focus on the terminology and concepts it employs. Because of this focus, there is now considerable disagreement between animal welfare scientists regarding different concepts of animal welfare and the theoretical and practical implications of each. While most animal welfare concepts can agree on what are considered pressing issues to address, they may sometimes conflict in their prescribed solutions such problems because of how each conceives of welfare. This is related to the different value sets represented by these different concepts (Fraser, 2008, p. 77).<sup>9</sup>

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<sup>9</sup> Although there are numerous distinct understandings among scientists of what constitutes good and bad animal welfare, three chief conceptions can be identified:

Animal welfare science is often characterized by its interdisciplinarity, incorporating knowledge from a variety of disciplines within the biological sciences (e.g., physiology, veterinary science, ethology, etc.), and sometimes even outside of it (e.g., economics, psychology, politics, philosophy, etc.) (Lund et al., 2006, pp. 41-42). Attempts to apply theories from other disciplines (e.g., natural selection, biological theories of “stress”, or theories of motivation) to research involving animal welfare has also resulted in disagreements between researchers, hampering the development of a coherent universally agreed upon account of animal welfare (Fraser, 2008, p. 80). Clarifying what these different concepts of animal welfare actually consist of was an important step toward progress in the discipline (Donald Broom, interview proceedings).<sup>10</sup>

Another challenge for the discipline was industry funded studies that were biased in favor of a particular conclusion. These threatened to damage the credibility of other work in animal welfare science and to get politicians to enact policies based on questionable scientific results. However, these studies often failed to be published in top journals, so their negative impact on the field is probably minor (Donald Broom, interview proceedings).

Finally, many animal advocates have been critical of how animal welfare science has been applied in practice. For instance, it has been claimed that the field is actually in

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- (1) Animal welfare as a biological/functional performance of animals, according to which animals are well if they function well in the sense of good health, normal growth and development, and normal functioning of the body.
  - (2) Animal welfare as the contents of animals’ affective states, according to which animals are well when negative affect (pain, fear, hunger, etc.) is minimized, and positive affect (comfort, contentment, etc.) is present.
  - (3) Animal welfare as the extent of animals’ expression of natural behavior, according to which animals are well if they are able to lead reasonably natural lives (Mellor et al., 2009, pp. 4-5; Fraser, 2008, p. 70).

The second one would be the one aligned with the understanding that welfare is about how good or bad we feel, the other ones being objectionable in light of this definition.

<sup>10</sup> Scientists who advocate for a multidisciplinary approach to animal welfare tend to talk about “the sciences of animal welfare”, rather than “animal welfare science”. For example, Patterson-Kane, a recognized animal welfare scientist at the American Veterinary Medical Association and coauthor of the book *The sciences of animal welfare* (Mellor et al., 2009), says:

I see animal welfare as an area of application for multiple sciences. So, I think it makes perfect sense to say I’m an animal welfare scientist because I apply my scientific knowledge and methods to helping animal welfare, but my discipline is psychology. (interview proceedings)

support of exploitative practices involving animals by being complicit in sectors such as industrialised animal farming, making these practices seem more acceptable to the public. Though they have introduced reforms within these sectors, these reforms have arguably made only a very small difference to the lives of animals in comparison to the huge harms they suffer, and fail to address more fundamental issues related to the legitimacy of such practices to begin with (Francione 1995; 1996; Dunayer 2004). This has sometimes led to a confusion among many animal advocates between such reforms and the science informing them, as the former are often referred to as “animal welfare reforms”.

## The role of external agents

Throughout the history of animal welfare science there have been scholars interested in the field’s development, and who have contributed their time and efforts towards this goal. However, there are good reasons to believe that they would not have been successful without the support of external agents. The work of Ruth Harrison was crucial for attracting public and legislative interest on farmed animal welfare, in addition to the work of a group of people within the RSPCA who promoted the creation of the scientific advisory committees. These agents were influential for the field directly, because their work influenced subsequent work in animal welfare science, and indirectly, because it raised concern among the general public about the field and influenced policy about it.

Other animal organizations raised awareness for animals in the public sphere which led to greater consideration for animals in general. In addition, these organizations increased political pressure, and in some cases funded work on animal sentience.

Most of the funding for the new discipline came from government sources, especially from the European Union. In many cases, funding was given to projects not out of concern for the animals themselves, but to further other goals. For example, motivations to treat animal diseases are primarily because of the potential beneficial effects such interventions might have on human health. Still, it is likely that the bulk of research funding related to animal welfare has to do with concern for the animals themselves, attributable to rising public concern for animals (Donald Broom, interview proceedings). Additionally, it is worth noting that legal requirements that animal welfare assessments be carried out meant that there have been many more job opportunities for people working in this field than there would otherwise be. This was another way in which the action of legislators helped the field to develop.

From our research, governmental agencies and other public bodies appear to have helped fund far more than the private donations of animal organizations or individuals

concerned about animals. In comparison to governmental sources, relatively small amounts of funding were provided by charities (Donald Broom, interview proceedings). This means that research on animal welfare science has tended to go in the direction of what has been regarded as important and useful for such bodies, rather than for those involved in animal advocacy.

Finally, animal welfare science has also received funding from companies and pressure groups involved in practices that harm animals, such as animal farming. In some cases, they have done so in an attempt to legitimize some of their practices which might otherwise be considered by animal welfare scientists to be quite harmful for the animals. In other cases, their reasons for funding this work may be to show a commitment to caring for the animals they use, even if such use is harmful to animals in many ways. That is, there may be certain harms that are intrinsic to a certain manner of using animals as resources, and others that aren't. A reduction of the latter harms may help make the former more acceptable to the public. This provides motivation for companies involved in the use of animals as resources to financially support animal welfare work that can help to reduce the harms that are considered unnecessary, even while still inflicting other harms.

It has been claimed animal welfare science has often worked to *increase* the productivity of animal exploitation industries, as research conducted in the field has previously been used to defend those industries from criticism (under the pretense that the welfare of animals is protected). As a result, many animal advocates and organizations now distrust the use of the term "animal welfare" and are reluctant to consider the positive contributions made by animal welfare scientists to the wellbeing of animals.

Despite this, the study of animal sentience is appreciated by animal advocates as a means to indirectly raise awareness about the moral consideration of animals, to learn more about which animals merit moral consideration, and to understand the needs that different animals may have. Animal welfare science as such is not to blame for human practices that harm animals; the field simply entails the scientific study of what is good and bad for animals, which can be separated from its potential applications. What many animal advocates have been critical of is the use of animal welfare science to justify animal exploitation by implementing minor reforms which do little to improve their overall condition. This has led to deep disagreements among animal organizations and theorists about this topic.

# Conservation biology

## Emergence of conservation biology

Conservation biology is a transdisciplinary field of study primarily concerned with the study of biological diversity and its conservation.<sup>11</sup> While the field had many ancient precedents in Egypt, China, Europe, and the Americas (Hunter and Gibbs, 2007, pp. 7-8), it has only gained status as a scientific discipline in the late 20th century (Meine, 2010, p. 7). Unlike the origins of animal welfare science (which mostly occurred on the European continent), the majority of conservation biology's early growth took place in North America (Callicott, 1990, pp. 15-18). However, the timeline from its beginnings as a field to its current state has been less obvious than in the case of animal welfare science. In our analysis we can distinguish two periods in the development of conservation biology as a scientific field. During the first period, there was an emergence of concern about the loss of biodiversity which attracted academic interest. During the second, the field received its title and became recognized as a legitimate field within academia.

To start with the development of interest in the issue within the USA, one early figure who wrote in favor of a conservationist approach was Aldo Leopold.<sup>12</sup> Leopold worked first with the US Forest Service and became a professor at the University of Wisconsin in 1935, where he helped to organize one of the first academic departments in wildlife ecology and management at a state university in the USA. In 1937 he helped to form The Wilderness Society, a conservationist non-profit organization composed of scientists, scholars and environmentalists (Van Dyke, 2008, p. 23). Leopold was influential mainly through the publication of his book *A sand county almanac*, which consisted of a series of essays on natural history, Leopold's own experiences, and environmental philosophy. It

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<sup>11</sup> Biological diversity or biodiversity is normally defined as all varieties of life in all its forms, including animals, plants and microorganisms, and at all levels of organization, including diversity of genes, populations, species, ecosystems, and landscapes (Hunter & Gibbs, 2007, p. 22)

<sup>12</sup> Before Leopold, there were early proponents of preservationist and conservationist views in the 19th century in North America, like Ralph Waldo Emerson, Henry David Thoreau or John Muir, but we have restricted our analysis to focus it on the development of conservation biology rather than of conservationist or preservationist positions.

didn't sell well at first but sales increased during the 1970s, so it is not clear whether it helped cultivate concern for conservation among the general public, or if the growing concern of the public led to increased sales of the book, or both. It is often mentioned by environmental ethicists (Curt 2010). It's an accessible text, not technical or dry, and was likely very inspiring for conservationists who followed. Leopold's work also influenced the US Forest Service to establish wilderness areas, and contributed to the passage of laws, such as the US Wilderness Act of 1964.

In the decades following the publication of this book, studies in resource management and wildlife ecology began to be recognized more widely within academia. The initial focus of these emerging research fields was on managing animal populations for the purpose of hunting them. However, in the late 1960s and 1970s, their development was also influenced by growing conservationist interests (Van Dyke, 2008, p. 23).

In 1968 the journal *Biological Conservation* was founded by academics from different disciplines who held conservationist views. Their purpose was to bring together in one place the widely scattered literature and knowledge relevant to the tasks involved in conservation activities (e.g., protecting endangered species). The establishment of this journal made it easier for those interested in conservation to publish and to keep up with work outside of their own individual field. It was also the first journal explicitly concerned with conservation, and therefore likely paved the way for later journals and books.

Shortly after the journal began publishing, David Ehrenfeld, a professor of biology with a background in medicine and physiological ecology published a book of the same title, *Biological Conservation* (Ehrenfeld, 1970). This book was an early attempt to set the basic grounds of the new discipline. In it, Ehrenfeld indicated how achieving this would require the involvement of practitioners and researchers from different disciplines and backgrounds (Franco, 2013, pp. 31-32).

In addition to these moves taking place within academia, there were other actions that increased interest in the issue among the general public. One that deserves special mention, as it was very influential to the spread of conservationist views and policies, was the publication of Rachel Carson's book *Silent spring* in 1962. This was a very successful book, remaining on the bestseller list for 31 months. Carson meticulously researched the effects of pesticide use. The book arguably inspired grassroots environmentalist groups. Before writing *Silent spring*, Carson had written several well received and best-selling books on ocean life and had won a national book award. She was a scientist, a well-respected author, and she had many useful contacts who were able to give her insider knowledge on pesticides, which contributed to her being seen as a trustworthy source (Hynes 1989; McLaughin 2010).

Public concern about this and related issues impacted legislation that was approved in the USA in the following years. This happened in the case of federal legislation, as the National Environmental Policy Act was approved in 1970, the Marine Mammal Protection Act and the Clean Water Act were both passed in 1972, and the Endangered Species Act in 1973. This new legislation increased the demand for scientific input into conservationist decision making (Meine, 2010, pp. 11-12). In particular, conservation biologists were required to carry out environmental impact statements in accordance with the National Environmental Policy Act, and the Endangered Species act required federal agencies to make use of the latest scientific evidence to list all species to be considered under this act (Meine et al. 2006).

During those decades, interest in the issue developed similarly in other countries. In 1948, the International Union for Conservation of Nature (IUCN) was founded, and in 1964, this organization published a "Red List" of species of mammals and birds whose existence was threatened (Simon, 1966; Vincent & Simon, 1966).<sup>13</sup> Since then, these inventories have been regularly updated, which has generated a constant demand for new data at a global level, requiring research by conservation biologists. Aside from increasing the demand for scientific research, Meine et al. (2006, p. 636) suggest that the IUCN red-listing process increased conservationists' interest in programs consisting in breeding animals in captivity in collaboration with zoos, one of the areas of conflict between conservationists and animal advocates.

During the 1970's, national legislation in a number of countries and a series of international treaties and multilateral agreements entered into force. This encouraged governments to take action for conservation purposes, increasing the worldwide demand for biologists actively working on conservation issues (Meine, 2010, pp. 11-12). One prominent example of this was the Ramsar Convention (1975). Considered one of the oldest multilateral agreements about environmental conservation, this convention is focused on promoting the conservation and sustainable use of wetlands. Although it entered into

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<sup>13</sup> The IUCN was the first global environmental union, and it brought together both governments and non-governmental organizations. Its aim is to further conservationist aims by encouraging international co-operation and by providing scientific knowledge and tools to guide conservation action. It has expanded from 65 members in 1948 to 1400 governmental and non-governmental organization members and 1,000 full time staff today. Since its foundation, the IUCN has had 1305 of its resolutions adopted, and has played a key role in creating various international environmental conventions such as the Ramsar Convention on Wetlands (1971), the World Heritage Convention (1972), the Convention on International Trade in Endangered Species, (1974) and the Convention on Biological Diversity (1992).

force in 1975 (with UNESCO as its depositary), the treaty, originally named “Convention on Wetlands of International Importance especially as Waterfowl Habitat,” was agreed upon in 1971 by 18 nations at a conference in Ramsar, Iran. Since then more nations have adopted the convention.<sup>14</sup>

Another major example was the establishment of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), a multilateral treaty for regulating international wildlife trade for conservation purposes. The text of the convention was agreed upon in 1973 by 21 countries at a meeting in Washington D.C., USA and it went into force in 1975. Since then, many new countries have become parties to the convention.<sup>15</sup> CITES puts in place international trade controls on certain species of plants and animals which are listed in three appendices according to how threatened they are by international trade. The list has therefore promoted research in conservation biology in many countries.

Like national legislation, these agreements increased the demand for scientific knowledge on conservation issues and likely helped to establish conservation biology as a field of study relevant to public institutions.

Despite all these antecedents, the emergence of conservation biology as a scientific discipline proper is often attributed to the First International Conference on Conservation Biology, which was held in 1978, and to the proceedings of this conference. The meeting had an ambitious name, gathering academics from a variety of different backgrounds and conservationists from outside of academia to address the topic of biological conservation and its scientific basis (Gibbons, 1992; Meine et al., 2006). It was also attended by zookeepers and took place at San Diego Wild Animal Park in California (currently named San Diego Zoo Safari Park).

The conference was organized by Bruce A. Wilcox, who was then a PhD student of biology at Yale University, Thomas Lovejoy, a biologist affiliated with the World Wildlife Fund (WWF) (also known for introducing the term “biological diversity” into the conservationist vernacular), as well as Michael Soulé, a biologist from the University of California (San Diego) who was Wilcox’s advisor and has been considered “the grand

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<sup>14</sup> In 2019, the convention had been adopted by 170 nations, with 2,341 Ramsar Sites designated, and covering over 250 million hectares (Ramsar List, 2019). Every site is supposed to be selected by its international importance in terms of ecology, zoology, botany, limnology or hydrology which has encouraged the involvement of scientists from these and other fields in actions regarding the conservation and sustainable management of wetlands in different territories.

<sup>15</sup> It had 183 members in 2019, being considered one of the conservation agreements with largest memberships.



architect of conservation biology” because of his publications and active participation in this and other events spanning the field’s development (Franco, 2013, p. 35). Wilcox recalls how these events unfolded:

I started out as that kind of person who studies plants, birds, nature, etc., but there was another part of me that was deeply concerned with the destruction of that. At the time — this was in the 70s when I was in my graduate work in ecology and evolution in the biology department at Yale — the field of ecology did not include talk about conservation or anything like that. It was very pure, and my feeling was that we needed more out of it. Ecologists didn’t want to mess around with policy and things like that. So basically, I’m young, I’m in my 20s, and 100 meters down the street from my department is the Yale School of Forestry and Environmental Studies — founded by the founders of the field of conservation (at least in North America). There was this whole resurgence at the time of being interested in wilderness and protecting nature, but it didn’t have a scientific basis. Biological conservation was an activity — sure it was a field, but it wasn’t respected within academia. So anyway, I could see how they were dealing with their problems in that school and how they could use the developments that were taking place in ecology. There was a whole body of theory that could get behind conservation but none of it was trickling over.

Later on, I had a talk with my friend Jared Diamond, and I said, “It seems to me there’s a big gap in population biology,” particularly all the biogeography he had been working on. I said to him, “We need some kind of an institution that brings these things together,” and he said, “Well, have a meeting, have a conference” and I said, “OK.” A few months later I met with Thomas Lovejoy — he’s the one that really promoted the term biological diversity in the 70s and 80s. So, I presented this idea to him and said, “Why don’t we have this meeting in San Diego?”. He goes, “Oh I have contacts with the Zoological Society, and we could bring in the animal genetics people, the breeding people... all these people, make it completely integrative.” He liked the idea of it and said, “I’m going to support you to do this and I’ll promise the money.” So, I went back to San Diego and talked to my advisor, he said, “Well, let’s go take that promise and go to the Zoological Society.” And so we launched this meeting, and from this meeting came the book *Conservation Biology* in 1980. Turns out it was a big hit since there were articles published about the meeting in all the big magazines like *Science News*, *Nature*, *Science*, and even some popular European magazines (interview proceedings).

This conference had a great media impact and its proceedings resulted in the book *Conservation biology: An evolutionary-ecological perspective*, in which Soulé and Wilcox (1980) gathered articles from its participants. The book is prefaced by Thomas Lovejoy, who argued in favor of the creation of the discipline. In the first chapter, entitled "Conservation biology: Its scope and its challenge," Soulé and Wilcox tried to give a general picture of the new discipline, and in the final chapter, titled "The strategy of conservation, 1980-2000," Paul Ehrlich presented, as the title indicates, a strategic plan for conservationism to follow in the next two decades. The book has been associated by many with the foundation of the discipline (Franco, 2013, p. 36). The conference also paved the way for future conferences and co-operation among scientists of different disciplines.

In 1985, a Second International Conference on Conservation Biology was organized alongside plans to create a society and start a journal (Soulé, 1987). It took place in the city of Ann Arbor, with the support of the University of Michigan (Franco, 2013, p). Before the meeting, two committees were formed to consider establishing a new professional society and a new journal, and at the conclusion of the meeting, attendees approved the motion to organize the Society for Conservation Biology (SCB) as well as the scientific journal *Conservation Biology* (Soulé, 1986; 1987a, Meine et al., 2006, p. 637). The conference had a very significant impact on the development of the field of conservation biology, and three important aims were achieved with it: the publication of a book based on the papers presented at the conference (*Conservation Biology. The Science of Scarcity and Diversity*, 1986), the creation of a new professional society, and the agreement to establish a new journal.

After the informal motion of creating a new professional society was approved, Soulé, (with the help of certain other people and organizations) held three meetings around the USA (at the WWF offices in Washington, D. C., at the Brookfield Zoo in Chicago, and at the San Diego Zoo in San Diego) where the constitution of the new organization was drafted and matters regarding publication and policy were discussed (Soulé, 1987). A few months later, on November, 1985, representatives of those meetings gathered at the University of Michigan at Ann Arbor, approving a draft of articles and bylaws as well as appointing a pro tem board of governors with Soulé as its president.

In 1986, the SCB was legally incorporated, and in 1987 it held its first annual meeting of 200 attendees at Montana State University and launched the journal *Conservation Biology* (Meine et al., 2006). In 1986, the U.S. National Academy of Sciences and the Smithsonian Institution organized the National Forum on BioDiversity in Washington, D. C., which gathered hundreds of scientists interested in the field in a wide range of fields (biology, agronomy, philosophy and others), representatives of technical assistance,

funding agencies and non-profit organizations (Franco, 2013, p. 22). The forum was broadcast via satellite to a national and international audience. The forum had an important media impact. According to Meine et al. (2006), “the broad impact of the forum and its proceedings ensured that the landscape of conservation science, policy, and action would never be the same” (p. 637).

The term “biodiversity,” an abridged version of the phrase “biological diversity,” began its etymological career in this forum, thanks to Walter Rosen, a program officer with the National Research Council, who started to use the term while organizing the event (Meine et al., 2006, p. 637). Contributors to the forum’s planning and program included many of the same scientists who have paved the way for conservation biology, such as Ernst Mayr, G. Evelyn Hutchinson, E. O. Wilson, Peter Raven, Hugh Iltis, Paul Ehrlich, Harold Mooney, William Conway, Michael Soulé, and David Ehrenfeld (Meine et al., 2006, p. 637, NAS, 1988). As on previous occasions, as a result of the forum, a collection of articles was organized (Franco, 2013, pp. 23-24).

After these events, affiliations to the SCB and the number of participants at the annual meetings more than tripled between 1987 and 1991 (Franco, 2013, p. 39). The rapid growth of the SCB was associated with the success of their journal *Conservation Biology*, which played an influential role in defining conservation biology (Meine et al., 2006, p. 640). Research projects and publications significantly increased, and many teaching programs began to specialize in conservation biology. Since the 1990s, a large number of textbooks have been published, and many programs in conservation biology at colleges and universities have been created (from 16 in 1990 to 108 in 2006) (Meine et al., 2006, p. 644).<sup>16</sup>

In addition to expanding in academia, after the mentioned events conservation biology also expanded in sectors such as resource management, policy and legislation, and international development (Meine et al., 2006, p. 640). In 1992, the United Nations hosted the “Earth Summit” in Rio de Janeiro, where the Convention on Biological Diversity was opened for signature by hundreds of nations.<sup>12</sup> In 1993, it entered into force with 168 signatures, influencing many countries to adopt conservationist policies (Convention on Biological Diversity 2020).

Job opportunities in conservation biology also increased within universities, non-profit organizations, and the public and private sectors, along with funding opportunities

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<sup>16</sup> Textbooks in conservation biology, many of which have multiple editions, include: Primack (1993); Meffe & Carroll (1994); Hunter (1996); Samways (1994) (insect conservation); Frankel et al. (1995) (conservation of plant biodiversity); Frankham et al. 2002 (conservation genetics); Norse & Crowder, 2005 (marine conservation biology).

for students, academic programs, and research projects (Meine et al., 2006, p. 644). By 1992 at least 16 new graduate programs in Conservation Biology had been established (Gibbons 1992).

Today, the discipline is very prominent within the biological sciences, and there are many university courses focused on it. It is also positively regarded by the public and informs many policies (Meine, 2010, p. 15).

## Challenges

Perhaps the most significant challenge faced by conservation biology was the academic community's aversion to research proposals that challenged the prevailing paradigm of the time. Conservation biology was considered by many to be incompatible with the standards of science at the time of its early establishment for two reasons: its value-ladenness and its practical foundation in problem-resolution. As Wilcox says:

For conservation biology, that really is the challenge: bridging the real-world problem with one conception of what an academic problem is, because they're different and you have to value both (interview proceedings).

The academic community's resistance to change manifested in the difficulties early proponents of conservation biology encountered when trying to fund events that would help to establish the field. When referring to the organization of the First International Conference of Conservation Biology (1978), Wilcox says:

When we submitted a grant proposal to the NSF (National Science Foundation) to get funding for the meeting, just a small amount of funding, it was rejected. The reviewers sent the money to wildlife, natural resources, and forestry people thinking that fields like population biology had nothing to do with conservation. And if you look, it's very hard to change the academic organizational structure, it's very conservative (interview proceedings).

One part of the scientific community initially responded to this new value-laden research field with resistance, skepticism, and even ridicule, resulting in tensions within resource agencies, departments, and conservation organizations. The prospective discipline of conservation biology was regarded by its detractors as a misguided response to trendy ideals and momentarily available funds, and then criticized for being liberally interdisciplinary, deficient in data and techniques, naive and ineffectual, professionally

unfeasible, and dismissive of knowledge gained in other disciplines and traditions (among other critiques) (Meine et al., 2006, p. 641).

However, as conservation biology grew, it gradually came to overcome this obstacle. For example, the Society for Conservation biology's sixth annual meeting in 1992, held jointly with The Wildlife Society, concluded that the disciplines of conservation biology and wildlife biology ought to be considered complementary to, rather than duplicative of, one another (Meine et al., 2006, p. 641).<sup>17</sup>

## The role of external agents

Bakker et al (2010) and Zavaleta et al (2008) have analyzed the level and sources of funding for Conservation Science and Conservation Work in the US and internationally. Both studies acknowledge the difficulty of finding funding figures in this area (Bakker, p. 436) (Zavaleta, p. 1479), chiefly due to the lack of any database of funding for conservation research. Bakker et al. analyzed funding sources for conservation science in the US indirectly. They did this by analyzing the funding acknowledgements in research articles published in the journal *Conservation Biology* between 1987 and 2009, and by sending a survey to members of the Society of Conservation Biology. Across the 482 articles analyzed, they found 1540 funding sources. Overall, 37% of funding came from the US federal government (including the NSF), 26% came from NGOs and foundations. Local government funding accounted for 20% and foreign and private funders accounted for 5%.<sup>18</sup> The results of their SCB member survey are consistent with the data obtained from funding acknowledgements. Internationally, Zavaleta estimates that between 1998 and 2005 the European Commission and the bilateral initiatives of 21 industrialized nations provided funding for conservation purposes varying in amount from \$900 million

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<sup>17</sup> In addition to the tensions between proponents of conservation biology and mainstream biologists, there were also tensions among researchers within conservation biology, as there were disagreements about conservation biology's fundamental priorities (e.g., sustainable use vs. protection, public vs. private resources, immediate needs vs. future generations) (Meine et al., 2006, p. 642). It has been argued, however, that this may not have been an obstacle, but a motivating strength (Strang, 2009; Pickett et al., 1999; Campbell, 2005).

<sup>18</sup> Bakker and Zavaleta estimate that in 2007 and 2009 foundations contributed \$139 million and \$119 million to conservation science respectively; the NSF contributed \$146 million and \$119 million; and the federal government excluding the NSF contributed \$1018 million and \$870 million. All figures are in 2008 dollars. (p. 442).

to almost \$2 billion (Zavaleta, p. 1479). However, this was to fund the field after it was already well established.

Meine et al. (2006) have pointed at the important boost that the Pew Charitable Trusts provided in the early years of Conservation Biology. In particular, they highlight their Integrated Approaches to Training in Conservation and Sustainable Development program which supported the establishment and development of the first formal graduate programs in Conservation Biology, and the “Pew Scholars Program in Conservation and the Environment,” which supported the work of leading conservation biologists (p. 640). They also highlight the importance of the Pew Charitable Trusts’ role in helping to establish Marine Conservation Biology as a distinct sub-field within Conservation Biology. The Trusts established and funded the Pew Oceans Commission, who produced a major report on the issue<sup>15</sup> and made concrete regulatory recommendations inspired by conservationist aims (p. 643).

Gibbons (1992, p. 20) has also pointed at “private foundations, such as the Pew Charitable Trusts and the MacArthur Foundation” as having an important role in the development of the field. In 1992 the MacArthur foundation spent \$17 million on conservation, and the Pew Charitable Trusts had a budget of \$15.5 million dollars to spend on research to preserve biodiversity. While the way this funding was used was diverse, it included an initiative to help universities set up training programs in conservation and sustainable development for their students. In addition, the National Science Foundation sponsored a \$2.4 million annual competition for funding in Conservation Biology (ibid, p. 22).

The initiative to found the IUCN came primarily from UNESCO, in particular, from its first director, the biologist Julian Huxley. From then on, it has been funded extensively by governments, multilateral agencies, NGOs, corporations, and other institutions, as well as by membership fees. Its income in 2013 was 116 million US dollars (IUCN 2013).

Rachel Carson’s *Silent Spring* was partly funded by the Audubon Society and by the Conservation Foundation (Lewis 1995). The Audubon Society recruited Carson, already a well known science writer, to research the US government’s use of pesticides. Further funding came from the magazine *The New Yorker*, who commissioned Carson to write a long article on the topic (Lear 1997).

The First International Conference on Conservation Biology, which we have seen was so important to the discipline, would not have been possible without funding. After it was rejected for funding by the NSF, Thomas Lovejoy, then director of the WWF, provided funding for the conference (Blue Planet Prize 2012). The second conference in 1985 was funded by the University of Michigan (Endangered Species 1984). The National Forum on

BioDiversity had the support of the National Academy of Sciences (NAS) and the Smithsonian Institute.

In addition, for the creation of the Society for Conservation Biology, funding and advice were provided by the WWF, the Chicago and New York zoological societies and the W. Alton Jones Foundation (Soulé, 1987).

Once it was created, the society organized conferences, published the *Conservation Biology* journal, and ran professional development programs for both students and professionals. It seems likely that all these activities had a significant positive impact on the development of the field.

There are other factors in addition to the money pumped into the field by large organizations that contributed to its development, especially public support. For example, public events such as the Earth Day celebrations in 1970 were possible mainly due to grassroots action, and were instrumental to promoting an ethos of conservation among participating countries. However, Kline (2011) claims that the older groups such as the Sierra Club and the Audubon Society played little or no role in this, and that they were not funded by any charitable foundations (Kline 2011).

The public's attitude also had an impact on legislation. The organization Environmental Action formed in 1970 to help co-ordinate Earth Day activities later "became an aggressive lobbying and public information group." The League of Conservation Voters, also founded in 1970, tracked the voting records of members of congress on environmental issues, and endorsed and organized electoral support for politicians aligned with their values. Groups such as these put pressure on politicians to become more responsive to their views. Mainstream groups such as the Environmental Defense Fund worked within the existing political and economic systems, and sought to bring about change through legislation, regulatory action, litigation, and electoral action. These groups hired a professional staff consisting of lawyers, scientists, fundraisers, lobbyists, and publicists (Kline 2011, ch. 6). We can expect that these actions had significant impacts on the increase conservation-oriented legislation in the following years.

This was possible due to support from the public. Organizations promoting work on conservation biology directly or indirectly (for instance, through legislation) had large memberships, which provided them with substantial funds to further their aims:

Of the 5 largest environmental organizations in existence in 1950, 3 experienced explosive membership growth during the 60s and 70s (one other stayed steady, and another grew modestly). Between 1960 and 1985, the Wilderness Society grew from 10,000 to 52,000 members (5x), the National Audubon Society grew

from 32,000 to 400,000 members (12.5x), and the Sierra Club grew from 16,500 to 246,000 members (15x) ( Muehlhauser 2017, citing Bosso 2005).

The increase in numbers of people interested in conservation also meant that the number of people in academia with an interest in conservation biology increased. Gibbons (1992) notes that 5,000 people joined the Society for Conservation Biology during its first six years of existence, and that even there was already a high demand among students for classes in Conservation Biology during this time (p. 22). Also, the demand for conservation biologists due to legislation and the growth of the field itself meant that students in this field would be able to get a job once they finished their studies.

So, to conclude, the above findings all show that the success of Conservation Biology as a field of study was helped tremendously by factors outside academia. Grassroots environmental groups, lobbyists, politicians, philanthropists and charitable foundations all played important roles in (i) making environmental conservation an issue that received support among the general public (ii) pressuring government to enact conservation policies which in turn increased the demand for conservation biologists and (iii) providing funding for research in Conservation Biology, as well as to environmental organizations and conservation workers. A wide variety of competing strategies were employed by different groups, some targeting the public or the authorities and legislators, and some of them targeting scientists. In addition, some focused on very specific conservation issues, and others on conservation more generally. This plurality of approaches by different groups with different understandings of the role of conservation biology might have helped it to be more successful than it would have been if only a single approach were employed.



# Cognitive ethology

## Emergence of cognitive ethology

Cognitive ethology is a branch of ethology concerned with the scientific study of animal minds and cognition (Ristau, 1992; 2013). While early forerunners to classical ethology date back to Hellenistic and Roman periods, modern cognitive ethology is generally thought to have its roots in mid to late 19<sup>th</sup> century Darwinian thought regarding mental continuity between humans and nonhumans (Moreno & Muñoz-Delgado, 2007, pp. 215, 217; Ristau, 1992, p. 125). Notably, Charles Darwin's 1871 book *The descent of man, and selection in relation to sex* (Darwin, 1871), and in the following year, *The expression of the emotions in man and animals* (Darwin, 1872) challenged anthropocentric concepts which placed humans above other animals on account of their assumed categorical superiority (Allen & Bekoff, 1997, p. 22). Animals began to be viewed in similar mentalistic terms as humans, marking the first serious treatment of cognitive anecdotes in research that studied their behavior (Jamieson & Bekoff, 1992, p. 111).

Despite all of this, cognitivist approaches to animal research had, since the beginning of the century, remained largely neglected and underrepresented since positivism and behaviorism began to dominate mainstream scientific thinking (Allen & Bekoff, 1997, p. 29).<sup>19</sup> Pushing past the limitations of these ideologies was crucial for the development of classical ethology, allowing for the eventual emergence of cognitive ethology. Following World War II, recognized scientists such as Konrad Lorenz and Nikolaas Tinbergen began to research animal behavior utilizing the methods and perspectives pioneered by Darwin and his protégé George Romanes (1884).<sup>20</sup> By 1973, Lorenz and Tinbergen (together with

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<sup>19</sup> Behaviorism, which gave no account of animal minds due to their non-direct observability, dominated the scientific paradigm at the beginning of the 20<sup>th</sup> century, and mental terms and concepts were abandoned, being replaced by behavioral ones. This rise of behaviorism corresponded with the rise of positivism in Europe during the 1930's and its strictly empirical method of verifying scientific hypotheses (Allen & Bekoff, 1997, pp. 26-28; Rollin, 1998, p. 68).

<sup>20</sup> Of the two, Lorenz's work more resembled Darwin's anecdotal and naturalistic explanation of animal behavior. Lorenz, regarded behavior as caused by internal states (*innenwelt*), while

Karl von Frisch) were awarded the Nobel Prize in Physiology or Medicine for their work on animal behavior, marking the beginnings of contemporary animal mind research.

A significant milestone in cognitive ethology's development, and what some (Allen & Bekoff, 1997, p. 32) have marked as its departure from classical ethology as a distinct branch of ethological inquiry, arrived with the 1974 publication of Thomas Nagel's philosophical paper "What is it like to be a bat?" (Nagel, 1974). Nagel's paper helped revive discussion about animal minds. Nagel and Harvard (later Rockefeller University) zoologist Donald Griffin were likely considerable mutual influences on each other on the subject (Carolyn Ristau, interview proceedings). Very relevant for the emergence of the field was the publication, shortly after Nagel's paper, of a book of Griffin's on the topic, about which Ristau notes, "The way I see it, the field really got its start from Donald Griffin's 1976 book *The question of animal awareness*" (interview proceedings).

The publication of this book (Griffin, 1976) and other landmark texts he would continue on to publish throughout his career (e.g., Griffin, 1978, where he introduced the term "cognitive ethology"; 1984; 1991; 1992) stood in sharp contrast to the legacy of positivist thought which still persisted in other facets of science (Bekoff & Jamieson, 1990, p. 156; Colin Allen, interview proceedings). And despite attracting criticism upon its release, the book served as an important marker of the field's emergence by both formally naming the field and by providing stimulating questions for cognitive ethologists like Griffin to investigate as it continued to develop throughout the fourth quarter of the 20<sup>th</sup> century (Ristau, 1992, p. 125). Griffin seems to be the person who inspired the discipline (Dale Jamieson, interview proceedings). Though he did not personally try to build institutions for this new field, his intellectual influence is undoubted (Colin Allen, interview proceedings).

Much of Griffin's writing on the subject was done in the last part of his career. In his earlier career, he had built a reputation as a respected scientist, and it seems likely that this was important in allowing him to have the influence that he did on cognitive ethology (Carolyn Ristau and Colin Allen, interview proceedings). Because of his efforts to pioneer the field, cognitive ethology now has some recognition as a distinct area of scientific

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external stimuli releases or blocks behavior, and argued that research in behavior biology should abandon the positivistic notion "that it is possible to be objective by ignoring one's feelings" (Jamieson & Bekoff, 1992, p. 112). Tinbergen complimented this approach by conducting reproducible field experiments to support and further elucidate Lorenz's mentalistic notions of internal 'instinctual' drives motivating animal behavior (Jamieson & Bekoff, 1992, p. 112).

inquiry, and attempts to understand the subjective experiences of other animals have become much better respected within the scientific community.<sup>21</sup>

One factor that may have aided the growth of the field was recasting earlier research that could be interpreted quite straightforwardly in light of cognitive ethology. Some previous research may have avoided talking about the mental states of animals, but arguably could be better interpreted by referring to the mental states in animals. Cognitive ethology provided a new explanation for these past scientific findings. This helped to showcase the explanatory power and usefulness of the new discipline (Colin Allen and Dale Jamieson, interview proceedings).

Another factor that played a role was the influence of Jane Goodall's work with chimpanzees. This work was presented in terms that aligned with the assumptions of cognitive ethology, and it achieved a high level of popularity. The cognitive interpretations of animal behavior it presented were easily accepted by the general public. This made it less difficult for scientists to accept this perspective too. In addition, the work of other scientists, while not as well known among the general public as that of Goodall, helped to present the discipline as sound by providing compelling research examples in cognitive ethology. This included Carolyn Ristau's work on broken wing display and Marc Bekoff's work on play (Dale Jamieson, interview proceedings).

The rise of cognitive ethology can be seen partly as a consequence of the fall of behaviorism in psychology. The new focus on mental states in humans made it easier to apply this approach to animals. Some people, including Dale Jamieson and Colin Allen who were influential in cognitive ethology, made the connection between the declining influence of behaviorism in psychology and the general cognitive turn in that discipline, and they used this to advocate for making a similar shift in ethology (Dale Jamieson, interview proceedings).

Research on cognitive ethology was helped also because between 1979 and 1983 Griffin was the president of the Henry Frank Guggenheim Foundation, a position under which he encouraged such work through grants to researchers (Gould, 2004). In fact, the role of a small group of very dedicated authors including Griffin was crucial in shaping the field. In 1987, a symposium on cognitive ethology in honor of Griffin took place at the Animal Behavior society meetings at Williams College in Massachusetts. Animal cognition papers were a rarity at those meetings, so this was an unusual event. In 1991, Ristau

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<sup>21</sup> In *Animal Minds*, Griffin openly critiques the traditional behaviorist method of disregarding animal minds stating that "the difficulty, or even the impossibility of conveying to others the exact nature of something does not rule it out of existence or deprive it of significance" (Griffin, 1992, p. 6.)

edited a book with the title *Cognitive ethology* (1991), composed of papers presented at that symposium. Other books published in the 90s and early 2000s helped establish the field. They included *Animal minds* (1992), reedited as *Animal minds: Beyond cognition to consciousness* in 2001) by Donald Griffin; *Readings in animal cognition*, edited by Marc Bekoff and Dale Jamieson; *Species of Mind*, by Colin Allen and Marc Bekoff (1999); *Minding animals* by Marc Bekoff; and *The Cognitive Animal* (2002) edited by Marc Bekoff, Colin Allen and Gordon Burghardt. Note that half of these six books were compilations of essays by different authors. Note also that Marc Bekoff was particularly active in the production of scientific books introducing the field.

To conclude, we can see that there are very significant contrasts between this discipline and the two we examined above. Its history is much simpler, and one in which significantly fewer agents and events are involved. It is also one in which we can notice that it is mainly academics, and not external agents, who have participated. Further, cognitive ethology should perhaps not be considered entirely *as* successful as the previous two case studies since it remains not a very large discipline (Allen, 2004).

On the other hand, the perspective that it advocates does now seem to be much more widely accepted. The discipline appears to have been influential, though this hasn't translated into material success for it as a distinct discipline. Rather, it is more the case that the approach and core concepts of cognitive ethology have diffused out and been adopted by the wider scientific community instead of becoming clustered as a distinct field. This has happened especially in the case of cognitive sciences, where its impact has been very important. So, while few academics researching animal minds might consider themselves to be cognitive ethologists, their views now are much closer to the views promoted by cognitive ethologists at the time the field developed than mainstream scientific views (Colin Allen and Dale Jamieson, interview proceedings).

Marc Bekoff and Dale Jamieson (1990) write that "many researchers now accept the fact that the difficulty of studying animal minds is not sufficient justification for ignoring this area of research, or worse still, concluding that animals do not have minds" (p. 156). This follows from the period under which Griffin campaigned for cognitive ethology's serious treatment against lingering behaviorist and positivist attitudes in mainstream science. And likewise, the efforts of reputable scholars toward cognitive ethology's early establishment helped shift the paradigm of animal research to accommodate mentalistic descriptions of animal cognition.

The approach of cognitive ethology has also had an influence on the public. Jane Goodall's work changed the public's perception of chimpanzees, which helped to erode the idea that there is a clear divide between humans and other animals. This change in perception has probably done a lot to influence ethical attitudes towards chimpanzees

and perhaps other animals. People who recognize the sort of influence that cognitive ethology can have in this area might be motivated to try and advance the discipline in order to drive that influence in the future (Allen & Bekoff, 2007, p. 300). This can be explained by the positive reaction of the public towards cognitive ethology's principle of attributing mental states to animals.<sup>22</sup> This means that it is still an open question whether cognitive ethology might go on developing significantly further than it has to date.

## Challenges

It appears that for all three of the case studies we have assessed, a central challenge has been resistance to paradigmatic shift encompassing non-traditional scientific values (e.g., involving welfare, or normativity). As with animal welfare science, there was a small number of scientists who simply dismissed the approach of cognitive ethology out of denialism concerning animal minds (Bekoff 2002), but this is a view that has reduced over time, and very few still hold such positions. Still, many scientists did resist the notion that animal minds could be studied empirically. This has meant that there has been a strong resistance to accepting the approach cognitive ethology has defended.

While cognitive ethology emphasizes an understanding of animal minds as evolutionarily continuous with human minds and expects continuity in conscious experience, comparative psychology maintains more of a hard-line approach, preferring

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<sup>22</sup> Ristau notes about this:

The public is far more ready to ascribe mental states to animals than scientists are, like states of feeling, caring, fear — possibly in far excess than what the animals are actually capable of experiencing. They're more in the public imagination. The more you make animals seem like us, exhibiting intelligence, exhibiting abilities, both those we don't have and those we do have, makes them more like us and therefore makes us more likely to protect them. And certainly if you can exhibit evidence that they experience emotions our empathetic reactions are aroused. (interview proceedings)

Also, regarding the field's impact outside of academia, Bekoff notes:

I think it's had a huge effect on the masses. I write a lot of popular books and essays and so many people who read them go "Duh. Have these people ever lived with a dog?". I think it's been enormous, and I think its effects on researchers is growing. (interview proceedings)

not to commit to any particular explanation of cognitive events.<sup>23</sup> This ideological difference can cause confusion to adherents of either field when their research overlaps (as it very often does, given their convergence on key points related to animal cognition) (Allen & Bekoff, 2007, p. 308).

This does not mean that the results of research in both fields cannot be considered alongside one another. “More than anything,” Marc Bekoff notes, “they’re just different foundations and different bases for explaining and interpreting a data set” (interview proceedings). Carolyn Ristau furthermore adds that “there are some differences [between cognitive ethology and comparative psychology], but I don’t think they’re irreconcilable” (interview proceedings). Ristau also notes that

Skinner [a radical behaviorist] had such a strong hold on the field of psychology for so long and people in learning theory wouldn’t talk about anything like fear. There was a state called a “Conditioned Emotional Response” that avoided any mentions of states of mind. It was used to help maintain a distance between the state attributed to a rat and those attributed to a human, e.g. terms like “emotion.” I still remember the difficulty as a graduate student simply trying to write up an experiment describing the effect of a rat crossing a cage and pressing the bar to get food without using mentalistic terms! The mentalistic approach was truly discredited, and I think in many ways it still is (interview proceedings).

As such, one possible detriment of their parallel development might be that neither field reached its full potential if academics felt forced to publish in journals from one camp and not the other.

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<sup>23</sup> Differences separating the two fields other than their general aims include experimental variation (ethologists prefer studying animal behavior in their environments in the wild while psychologists tend to favor laboratory conditions), research methodology (cognitive ethology lacks formal research structure in comparison to comparative psychology which is more directed in its experimental strategies), and research limitations (cognitive ethologists have many more variables to account for in outdoor environments, though may have better access to possible indicators of cognitive states in observed animals than in confined testing environments where animals are less likely to exhibit natural behavior) (Vauclair, 1997, pp. 36 & 38; Allen & Bekoff, 2007, p. 309). One significant challenge to cognitive ethology Griffin noted was its qualitative difference to comparative psychology. Griffin’s critique rests primarily in the conceptual orientation of comparative psychology as a derivative of behaviorism which fails to fully consider the role of consciousness in relation to cognitive processes — processes which cannot be empirically proven as either conscious or unconscious (Jamieson & Bekoff, 1992, p. 113).

Cognitive ethologists tended to treat nonhuman animals as individuals with their own personalities rather than just assuming the minimum of animal minds until proven otherwise. While also reflective of cognitive ethology's inclusivity in studying animal sentience and consciousness, our interviews with field experts identified the generally conservative attitudes of scientific community members as a barrier to having material published. This challenge was overcome in part by involving recognized scientists who were able to be persistent with their approach, such as the primatologist Jane Goodall. Bekoff remembers:

When Jane Goodall started doing her work she named her chimpanzees and said they had distinct personalities, and people at Cambridge said, "You can't name animals and you can't talk about personalities and their emotions". And as it was Jane didn't agree, explained why she felt comfortable doing so, and has continued to do so for many decades. And she had a remarkable influence (especially among primatologists)... I used to cite her or mention her in committee meetings when they'd say, "Well you can't name that coyote George or Mary. And you can talk about positive and negative emotional states but you can't call them joy or happiness," or something like that. I just said, "I'm doing this field work without watching animals running around a maze or a cage, and we name these animals because that's how we identify them, and we named them because we're respecting their individuality." And we had a couple of people say, "You can't publish. We liked your data but we can't publish this kind of stuff." But I persisted and others persisted and things have really changed (interview proceedings).

Another obstacle that emerged was criticism of evidence that was considered anecdotal. Since cognitive ethology was seen as heavily tied to Donald Griffin, the field faced criticism of his approach in particular. Some scientists rejected the label because they saw his approach as too anecdotal or unsystematic. This greater comfort with the anecdotal is a tendency that has to some extent continued in the discipline and this may also have fueled its rejection by scientists (Colin Allen, interview proceedings).<sup>24</sup>

Finally, because of the general reluctance among scientists to value the wellbeing of animals, cognitive ethology developed as a study field without being explicitly concerned with improving the welfare of animals. Rather, as Ristau notes:

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<sup>24</sup> Carolyn Ristau, however, argues that there is a difference between an anecdote and one time observation made by an experienced researcher or field worker (by indicating that intelligent behavior is often manifested by a novel behavior, hence a likely rare or one-time occurrence (interview proceedings).

Donald Griffin tried very hard to avoid normative questions. Not because he was negative about animal wellbeing — not that at all — but he felt he was fighting a big battle just trying to engage in cognitive ethology study rather than becoming active in any animal welfare activities. So he looked at the issue from a distance very purposefully (interview proceedings).

Bekoff adds that Griffin “mostly steered clear of [normative] discussion because he just didn’t want to get embroiled in any controversy — he wanted to keep a focus on what he was interested in, namely, the evolution of consciousness. The field was already so controversial” (interview proceedings).

This does not mean that practical developments in how animals are treated may never result from research in cognitive ethology — in fact they do — only that having such an impact was not presented as being a direct objective of the discipline (Vauclair, 1997, p. 38). Still, this attitude seems to have changed in the last two decades, especially as Bekoff, a prominent champion of cognitive ethology, has not been as reluctant as Griffin to point at the practical normative implications of cognitive ethology for the moral consideration of animals (Dale Jamieson, interview proceedings; Bekoff 2002; 2010; Bekoff & Pierce 2009).

## The role of external agents

As we have seen above, external agents have not played a role in cognitive ethology like they have in animal welfare science and conservation biology. We have seen that in order to explain the development of these other two sciences it was necessary to speak of many other factors occurring outside academia, which ended up driving more work being done in those two fields. This has not happened in the case of cognitive ethology. In line with this, it appears that the field did not receive any substantial external funding for its development (this doesn’t mean that there has been no support at all, there have been exceptions such as Henry Frank Guggenheim Foundation’s under Griffin’s direction, but they have not been comparable to the key support animal welfare science and conservation biology have received). The funding for research in the discipline likely came from traditional sources, such as universities. That is, researchers did not get funding specifically to assess animal minds with a more cognitive approach (Dale Jamieson, interview proceedings).

There is a straightforward explanation for this. Not being recognized as a field whose development could be of any practical use, external actors have had no incentive to fund



it. People who could have been interested in the development of the field are those interested in the moral consideration of animals and its practical implications. Organizations interested in this, as well as governmental agencies and other public bodies, have funded research in animal sentience and animal welfare science.

Also, animal welfare science, like conservation biology, has an applied dimension that facilitates getting funding, as fundraising can be carried out for specific projects whose practical use is easy to identify, to evaluate and to measure. This has not been the case of much of the work carried out in cognitive ethology.

This might lead us to think that cognitive ethology was created exclusively out of scientific interest and with the means available to scientists (and philosophers) alone. In fact this is not entirely true, since, despite all we have seen concerning cognitive ethology not being a normative-driven field, it is nonetheless the case that concern about animals has been a leading force driving many scientists in this field to work in it. The development in the last part of the 20<sup>th</sup> century of the different movements for the defense of animals may therefore be seen as one of the causes of the growth of cognitive ethology. In fact, as indicated above, in more recent decades cognitive ethology has been defended in clearly normative terms, especially by Bekoff, who has combined the study of animal minds with the exploration of the moral consequences of his and others' findings in the field. This being said, the lack of involvement of external agents in promoting cognitive ethology has meant this field has not been in the position in which others, like animal welfare science or conservation biology, have been in order to successfully meet the challenges to their development that they faced.

# Lessons for establishing a new field of research

In our investigation of the development of several scientific fields, we have looked at several actions that were very important to their success. Some were internal to academia, involving actions by scientists. Others, which have in some cases been decisive, were carried out by actors outside academia. This raises two practical questions:

- (i) what can scientists do to increase interest in some unexplored area of research?
- (ii) what actions can external actors take to support that research, and to ensure the new field takes hold in academia?

These are closely connected questions, because what scientists will be able to do will depend essentially on the support that they receive, and the ways in which external agents can help the field to develop will also depend crucially on the level of support it has among scientists. For the sake of clarity, however, we will consider these two questions separately.

## What scientists interested in a new field can do

### *High impact actions*

We have seen that several actions had a very noticeable impact on the development of the different fields we considered. They include the following:

*The publication of influential academic papers, books, and conference proceedings that raised interest in the issue among scientists.* These publications played a very important role in building each of the fields we have seen, by laying some of its conceptual foundations and leading others to work in the field too.

*The organization of conferences.* In the case of conservation biology in particular, the organization of two international conferences played a very important role in making

the field visible. They also allowed academics to get to know each other and cooperate more easily, in addition to facilitating the exchange of information.

*The establishment of influential professional organizations.* This occurred for animal welfare science and conservation biology, although not for cognitive ethology. These organizations improved the ways scientists cooperated and provided the disciplines with respect.

*The creation of specialized journals.* These were important not only because they made the new field more visible, but also because they increased the opportunities for scientists to publish their work. In addition, they made new discoveries more easily available.

*Training programs.* These made the field more accessible to new scientists, helping them to become familiar with the ideas of the new discipline. They have also been a way of recruiting scientists supporting the establishment and growth of the field.

### *Impactful actions may be unfeasible at very early stages*

As we can see, all the actions mentioned above are all relatively common sense ones. It seems that all those intending to create a new field will want to execute them. However, as we have also seen, with the exception of the publication of relevant texts, they all require the existence already of some level of interest in and support for the field.

Conferences presumably succeeded because of (1) the momentum and concern that had been building over time, (2) the number of interested academics who attended, and (3) the funding and support of interested organizations. As for organizations of scientists, they can be set up even by a small group of researchers. But their capacity to be helpful and influential will depend on how many members they have. Without a large number of scientists interested in disciplines like animal welfare science or conservation biology, the societies of scientists working in those fields wouldn't have achieved the impact they did. Something similar can be said in the case of journals, as they are viable only if they can count on a sufficiently large number of scientists who submit high quality papers. This seems to explain why comparable actions have not been pursued in the case of cognitive ethology, where there are no similar organizations or specialized journals.

Finally, training programs can be of different kinds. They can be programs officially recognized at universities such as master's or PhD programs (or even degrees). These programs can be approved by universities and are often promoted by professors at those institutions. But this is unlikely to happen if a discipline has not already been established.

In addition, there can be small training programs intended to complement official studies, like summer courses for students or scientists at different points of their careers (targeting especially graduate students and postdocs). These can more easily be organized, although they require a sufficient number of scientists trained in the field to teach them as well as funding.

### *What individual scientists can do at early stages*

In light of what we have seen, it might look as if there is not a lot that individual scientists wanting to establish a new field at very early stages can do. However, this is not the case. In fact, their work is crucial for the development of the field. They can start to do research in the field and try to publish their results in respected scientific journals. Such early research may be among the most important in the discipline, and can speed up its development. The work of these innovators may therefore be among the most important for the development of the field.

In addition, scientists at very early stages of a field's development can also engage in other ways to reach other scientists who might be interested in the issue (such as seminars and personal communication).

At a later point, once there is more interest in the issue among other researchers, they could try to engage in activities like the ones indicated above. They could organize events. They could also try to create courses at their academic institutions and publish textbooks with theoretical advancements and empirical research results. Those efforts, however, appear to require support by other scientists. At some point, books that give comprehensive coverage of areas in the prospective field can also be published.

### *Getting support from established scientists*

Interviewees participating in this study pointed out that academics and scientists involved in the formation of the three fields we analyzed were considered reputable in their own fields. In order to gain legitimacy, new fields benefit a great deal from the involvement of recognized scholars from other fields. Patterson-Kane indicates that a new interdisciplinary field would need authoritative figures from different backgrounds to thrive:

Practically speaking you have to have highly authoritative people involved who are securely based with funding and tough leaders or whatever you want to call it. And they need to be from more than one fundamental discipline or culture, so

it needs to not be captured by a special interest because that will allow people to discard it. I would say if you had people who already have standing in a traditional area and they move into this area and they say this is important and this is what we need to do now... I think that's what it needs to exist, authority and diversity from the beginning because I've watched some groups that don't have important people, so they're ignored. Doesn't matter if they're right, nobody cares what they think. And you can't convince someone your messages right simultaneously with convincing them that you're someone they should listen to (interview proceedings).

Moreover, established scholars in important positions can also sometimes be instrumental in funding being given to new areas of research (as we saw in the case of Griffin at the Henry Frank Guggenheim Foundation). However, at the very early stages of a new discipline it may well be that there is no such established figure to back this new work. Outreach to reach established figures can be done, though the likelihood of success for such actions is uncertain. Another possibility is that scientists interested in the field become respected so eventually their views will be heard. This, however, implies that they will need to focus their work in other areas of research, which has a significant opportunity cost, as it means not working in the actual field they want to promote. In addition, building a reputation within academia can take many years, if not decades, and there is no guarantee that they will succeed in achieving that. Given all of this, one might simply choose to work within a new field of research even if there are no major figures backing it and no prospect of this happening in the short- or mid-term, and then try to make progress in some other ways.

### *Working out a clear conceptual framework*

Let us consider now the way researchers wanting to build a new field can present their work. One relevant consideration is that, as the key concepts used in the field will be new for scientists only familiar with the previously existing areas of work, it seems necessary to work on the definition of such concepts, as well as on the clarification of the concrete principles, criteria and protocols facilitating future research and publications in a given topic. Concerning how new ideas can become more appealing to scientists, Wilcox suggested:

It has to be measurable. There are going to be people who understand the philosophy and the theory and everything else, but most people don't. They just

want to be told what to do, “give me a problem to address”. It took me years to learn that people need real protocols. People just say: “tell me what to do, I don’t understand the philosophy underlying the principles” (interview proceedings).

In addition, this clear conceptual framework also needs to be understood by the target audience, which is composed of both the scientists that the new field can recruit and the external agents that can help promote it. It is important to adapt the message to different audiences, translating the principles underlying the new field to an appropriate language according to each audience. As Wilcox suggests:

You have to appeal to many different audiences... You have to translate that [philosophical basis] into a practical basis. It’s like everything you know, you have to sell it, it has to be clear, you have to have a simple message that can’t be too complicated. And then you acquire your audience (interview proceedings).

This can sometimes be difficult as there can be disagreements on what is the correct interpretation of key concepts within a given field. We saw this in animal welfare science, where different interpretations of the animal welfare concept and methods for its assessment have resulted in contradictory conclusions and confusion for some of its practitioners. Also, in the case of conservation biology, interdisciplinary aspects of the field have been especially challenging in terms of multidisciplinary teamwork involving researchers from different disciplines, as their language and research methods differ in significant ways. Despite this, as these fields are already established, these problems are not insurmountable. However, they may be more important in a new field of research.

### *Address or silence the normative implications of the field?*

For a new field to be created, there are two main goals to consider stemming from obstacles which it must overcome. One of these goals is positive: it consists in getting researchers interested in the field and performing work in it. The other one is negative: it consists in overcoming the resistance that will exist in academia. What we have seen above has focused for the most part on the former, and we now consider the latter. Major challenges encountered in the emergence of the three fields analyzed are associated with tensions within the scientific community. Specifically, resistance to accepting new approaches not aligned with the prevalent paradigm, which introduce non-mainstream concepts and methods. Two other challenges related to this are also important: skepticism towards cross- or interdisciplinary approaches, and disregard for normative

views different from established ones. These challenges were all reflected in the difficulty of publishing research papers in traditional journals.

It is impossible to completely avoid resistance when a new idea is presented that diverges from the mainstream paradigm. Avoiding this would go against the recommendation above that we need to clarify the new concepts and methods of the field that is being proposed.

Also, if the new area of research is located at the intersection of different fields, then the cross- or interdisciplinary character of the new proposed research program will likely become apparent to outsiders (Emily Patterson-Kane, interview proceedings). Efforts to obscure this would mean providing a confusing view of the actual area of work that is being proposed, and even failing to actually promote it at all.

As for the normativity of the field, it could be possible to silence it. In fact, one interviewee participating in this study suggested taking a very cautious approach as a way to face challenges like disregard for normatively loaded views. Wilcox notes, “my advice is be careful, be low key. If you believe in it, don’t try and be explicit, don’t push too much, be somewhat covert in your thinking” (interview proceedings).

On the other hand, this study has indicated that the field that might be considered the least successful of the three we have considered, cognitive ethology, was actually the one that was most cautious in this respect. It may be said, however, that such caution was actually the result of it being a field with little support in comparison to the other two, rather than being the cause of it. But it is hard to estimate to what extent a different approach might have allowed this discipline to be developed more successfully. We have also seen that funding was provided to animal welfare science and conservation biology precisely because of their normative approach. So we might wonder whether having a more clearly normative approach would have led to getting substantially more funding that could have helped to develop cognitive ethology. Perhaps some of the funding received by researchers doing animal welfare science could have been directed instead to work on cognitive ethology if the latter field had been considered more relevant to the question of how animals feel.

It could be argued that this would have been a problem for the credibility of the discipline among fellow scientists dismissive of the moral consideration of animals. Overall though, it isn’t clear whether such dismissal would have been more important in terms of impeding the actual advance of the field than the support that the extra funding might have brought. After all, we have seen that animal welfare science faced the same kind of dismissal and yet successfully developed due to external funding. Furthermore, there are scientists who have continued to be reluctant to accept cognitive ethology

because they have identified it as normatively-driven all the same, despite the efforts of cognitive ethologists not to give this impression.

## What external agents supporting a new field of research can do

We can now consider what kind of actions might be taken outside academia to help a new field develop. We saw that the success of animal welfare science and conservation biology depended crucially on factors outside academia. Without external support, conservation biology would have probably emerged anyway, perhaps in some other form, though its impact would have been significantly smaller. Before the large conferences and the creation of the SCB and the journal *Conservation Biology*, there had already been books on the issue, and the journal *Biological Conservation* existed already. Many scientists were already interested in the issue. Still, the field was created with the important participation of external agents as well. Without external funding and professional demand for conservationists, early conservation biologists couldn't have organized conferences or training programs in the same way they did, and even though the interest of a relatively large number of scientists made the journals in the field and the SCB possible, external help also made an important difference here.

In the case of animal welfare science, external factors were even more decisive. There is little to suggest that this field might have been created if not for external agents (at least not during the time of its emergence). In fact, this is a very clear example of how a new field can be created by being mandated externally. A significant increase in public concern about the situation of animals led to the issue being considered in policy and legislation, which then led to funding and work being provided to animal welfare scientists. This happened even though there was no significant interest beforehand about the issue among scientists. In fact, this happened even though this field received less support than conservation biology, as well as being less spread geographically (animal welfare science has been supported mainly in Europe).

This shows how critical external support can be. This means one important action external supporters can take consists in convincing others working in their cause of the importance of supporting academic research about it. We will see now some other actions external supporters can take to actually help to create a new field.



### *Funding work in the new field*

The most obvious way external agents can promote a new field of research is by funding research in it directly. But the ways in which they can do this depend on two things. The first is the amount of resources they have. The second is the stage which scientific work in the field is at. So, if large amounts of money are available to fund new research, or if new legislation is approved requiring experts in the fields, new academic programs or positions can be created, and large research projects can be funded. If this does not happen, but smaller amounts of money are available, the organization of large conferences or the creation and activities of professional societies could be funded. However, for this to happen, scholars must already be involved in the fields, which may not be the case when the field is just being established.

This leaves us with what can be done when there are only modest resources to fund research in a field, and when that field is in its very early stages. As we have seen, at such a point, high impact actions like large international conferences or the creation of new societies or journals are not a feasible option. But it is possible to support the work of independent scientists interested in the field. External funders can provide grants to researchers and fund small projects. They can also provide funding for minor events like seminars or small conferences, and work to put scientists interested in the area of knowledge from different places or even disciplines in contact. At some point they can also fund small training programs to interested scientists or students.

### *Raising awareness among the general public*

In addition to working with scientists, other people wanting to support a certain field can advocate to the public about its importance. We have seen examples of this with animal welfare science and conservation biology; certain actions had a very important impact on the general public. In particular, the publication of influential books that helped to motivate concern for the cause area among the general public was very effective in the case of *Animal Machines* and *Silent Spring*. These suggest that a book of the right sort at the right time can have a big impact. After books with such a large effect, other publications can mark the development of the field, even when their impact is basically academic.

There are different ways in which raising awareness among the public with a very influential book can help an academic field to be established. In the case of animal welfare science, it was mainly due to the political action such growing awareness triggered. But

there are other ways this can happen. One is that raising concern among the public about a certain issue can also cause more scientists to care about this issue. This is simply because scientists are part of the public. This means that if a significant percentage of the public gets concerned about a certain issue, statistically it is to be expected that some number of scientists will become concerned as well. This happened especially in the case of conservation biology.

In the case of cognitive ethology there has not been a book as influential as those in the other two fields in promoting a new field of research. A recognized scholar in the field like Marc Bekoff has published some successful books, though less than the previously mentioned ones.<sup>25</sup> However, the success of these books has not translated into more support for cognitive ethology. A hypothesis of why is that the public has not been moved by its interest in the topics addressed in these books to put pressure on politicians to fund work in this field, or to directly donate to it.

It is important to bear in mind that the kind of impact a book can have on the public may also be caused by some other cultural product. It could be a film, for instance, or maybe campaigns or other initiatives reaching a significant part of the population, including those carried out online.

### *Lobbying*

We have also seen that the work of lobbying organizations and initiatives from the public can spark work in a certain field. To be sure, public support for a certain cause need not trigger automatically the promotion of a new academic field focused on that cause. But if there is public support for a certain cause and the public gets organized and acts in ways that can put pressure on legislators and the authorities, then this can increase the funding being spent to address that particular cause. This may be achieved by providing funding that can indirectly promote it, by leading to the drafting and passing of pieces of legislation and public policies that must be informed by scientific work in a certain field and with a certain approach. A problem with this course of action, however, is that it typically requires very large amounts of resources, which perhaps may have a more significant impact if used in funding research directly.

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<sup>25</sup> Jane Goodall has also published books (see especially 1971; 1986) that have been very popular and can be identified as having a cognitive ethology approach; however, they have not been identified by the general public or in academia with the field.

# Conclusions

A main takeaway from this study is that extracting knowledge on how new academic fields develop is very difficult as there are many factors that can drive them in different directions, and which can depend crucially on circumstances external to academia. There are few clear practical indications we have seen that can be applied generally and that do not point at relatively common sense actions to raise attention and gain support for a particular cause. Despite all this, we have also considered above several ideas that might be useful when considering how to best advance new fields of research, from both inside and outside academia, even at very early stages. We saw that while scientists may think they should not to be explicit about the normative implications of the field to avoid dismissal by other scientists, this may also imply losing support for the field, especially from external sources, which can fund work in it. As for those wanting to externally support the creation of a new field, we saw that they should be well aware of the actual state of research in that area when deciding how to act, as the success of different courses of action may depend on the level of interest in that field within academia.

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