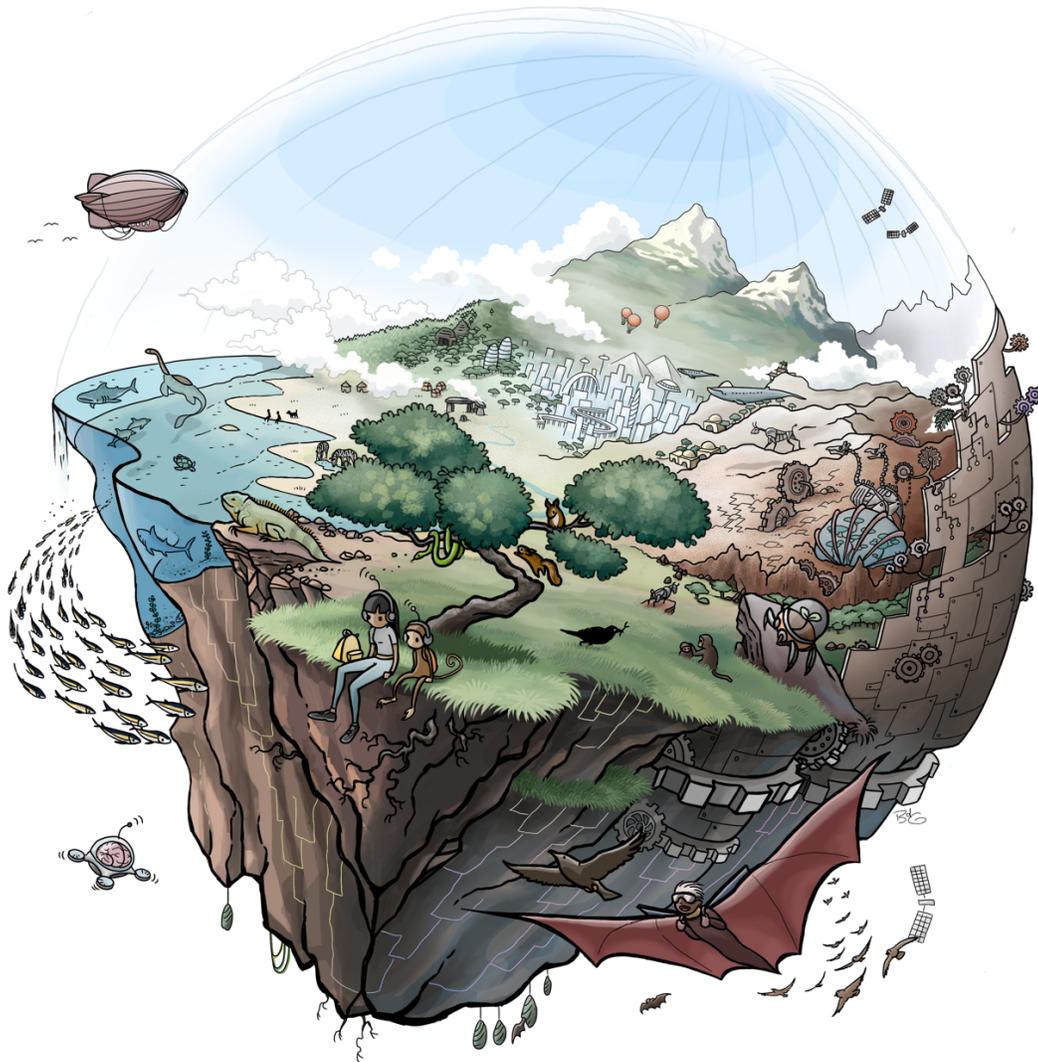# The Atlas of Intelligences:
A Diverse Intelligences Resource

Authors

Ali Boyle

University of Cambridge; Senior Research Fellow, Leverhulme Centre for the Future of Intelligence

Kensy Cooperrider

University of California – Los Angeles; Associate Director, Diverse Intelligences Summer Institute (DISI)

Lucy Cheke

University of Cambridge; University Lecturer in the Department of Psychology and Director, Kinds of Intelligence Programme

Marta Halina

University of Cambridge; University Associate Professor in the Philosophy of Cognitive Science and Senior Research Fellow, Leverhulme Centre for the Future of Intelligence

Stephen Cave

University of Cambridge; Director, Leverhulme Centre for the Future of Intelligence

With illustrations by **Brenda de Groot** (DISI alum)

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FUTURE OF INTELLIGENCE

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Executive Summary

The Diverse Intelligences initiative, funded by the Templeton World Charity Foundation, is an ambitious multiyear effort to better understand our world's diverse forms of intelligence. As the initiative enters a new phase, one idea for cementing its legacy is to build an **Atlas of Intelligences—a dynamic, encyclopedia-like reference work devoted to topics in diverse intelligences**. Such an Atlas would document and synthesize existing DI research, making it more accessible to those inside and outside academia, and would catalyze further cross-disciplinary work in this area.

We conducted a **scoping study** to determine whether there was both need and enthusiasm for the idea of an Atlas, and to explore what form an Atlas might take. We sought to answer questions in four key areas:

1) **Existing Landscape**—What resources do people currently use and favor when trying to understand and explore DI research?
2) **Imagining the Atlas**—What new resources would be considered most desirable and what features should those resources have?
3) **Diverse Audiences**—Do diverse groups of potential Atlas users (especially academics vs. non-academics) have different needs and preferences?
4) **Operational Issues**—How could the Atlas achieve financial sustainability and what are the best ways to incentivize contributors?

To answer these questions, we conducted: **semi-structured interviews with 6 editors of existing similar resources**; a 15-minute **broadcast survey with 283 potential users**, from diverse user groups; and **semi-structured interviews with 17 potential Atlas users/contributors**, also from diverse user groups. We present our findings from these three strands of data together, as they pertain to each key area of investigation.

With respect to the **Existing Landscape**, we found that prospective users most often rely on peer-reviewed journal articles and most often find them by using tools like Google Scholar or generic search engines. Respondents reported that it's especially challenging to find work that synthesizes DI research, and that accessible treatments beyond one's own discipline are also particularly difficult to find.

With respect to **Imagining the Atlas**, we found that potential users would value new resources that provide accessible overviews, offer links to curated sets of existing resources, and help build community. Users are also enthusiastic about a resource incorporating non-textual elements such as figures, videos, and visualizations of connections between topics.

With respect to **Diverse Audiences**, we found that the type of new resource that would have the *broadest* appeal—to both academics and non-academics—is an online encyclopedia. While all potential users are excited about non-textual content, non-academic respondents are more enthusiastic about video, whereas academic respondents are more enthusiastic about static images and figures. Compared to non-academics, academics place a higher value on content that is written and vetted by experts.

Finally, with respect to **Operational Issues**, potential users are positive about all versions of the Atlas in which content would be free, with a preference for models in which funding is generated through advertising, sponsorship, and donations over a "freemium" approach involving add-ons for paying subscribers. Most academics expressed a willingness to contribute to the Atlas in several ways (e.g., authoring, reviewing), and the perceived prestige of the resource would provide the biggest incentive to do so.

Based on these findings, we propose a version of the Atlas that we believe would fill a pronounced gap in the existing resource landscape and which would meet the needs of diverse user groups. The proposed Atlas would be free to use, visually rich, written in accessible prose, and regularly updated. It would consist of:

- brief **high-level overviews** with accompanying annotated bibliographies (approximately 1000 words)
- longer **in-depth articles** on key constructs, experimental paradigms, theoretical frameworks, and phenomena (approximately 3000-6000 words)

Both types of content would feature hyperlinks to other content within the Atlas, as well as curated links to resources outside the Atlas. All pages of the Atlas would prominently feature search functionality.

Factors that would greatly improve the odds of success for an Atlas include:

- the **backing of academic institutions**
- an editorial or advisory **board with "star power"**
- a **founding set of articles** by top-flight contributors

The day-to-day work of putting together such a resource would require a small team of editors and other personnel, bringing combined expertise in:

- a broad range of Diverse Intelligences **subject matter**
- **graphics** and **video**
- **audience engagement** and **social media**
- **web analytics**
- **fundraising**

Though the Atlas of Intelligences is not without challenges—and though several questions about how to implement it remain to be addressed—the potential value of the resource is considerable. It thus presents an exciting opportunity to capitalize on and consolidate the success of the Diverse Intelligences initiative.

Box 1: Key Takeaways

- An Atlas of Intelligences—a dynamic, encyclopedia-like resource—would appeal to a broad swath of academics and non-academics interested in Diverse Intelligences research.
- The appeal of such an Atlas lies in its potential to bring together work from across disciplines and present it in an accessible way.
- An Atlas would be especially appealing if it were free to use and visually rich, containing both high-level overviews and in-depth treatments.
- Challenges to the success of the Atlas include identifying a sustainable funding model and incentivizing contributions.

Introduction

Apparently intelligent behavior is seen in a wide range of organisms and systems—from human social interactions to bee navigation, and from decentralized decision making in slime molds to artificial systems that surpass humans in chess. Researchers study this **diversity of intelligences** from many disciplinary perspectives—psychology, evolutionary biology, computer science, philosophy, and beyond—in an attempt to understand the nature of intelligence.

The Templeton World Charity Foundation's Diverse Intelligences (DI) initiative is an ambitious long-term effort to bring these disciplines together to advance our understanding of the diversity of intelligences that exist in both the natural and human-made world. This DI initiative has been building a new scientific community, one organized around a target of study rather than disciplinary boundaries and norms.

This cross-disciplinary approach to the study of diverse intelligences promises to rapidly advance our understanding. But it presents several **challenges**.

A first challenge is **building a shared knowledge base and vocabulary** that incorporates research from across disciplines. Since different disciplines conceptualize and discuss intelligence in different ways, it is easy to overlook fertile connections.

A second is to **sustain and further develop the interdisciplinary DI community**. Since there are currently no academic departments of Diverse Intelligences, how else might we keep the interdisciplinary study of diverse intelligences alive and catalyze future work in this area?

A third is to **realize the potential impact of our growing understanding** of diverse intelligences: to find ways to communicate this understanding effectively beyond the DI community, both to the interested public who might be enriched by this knowledge, and to researchers in other fields who might use it to advance scientific and technological progress and promote human flourishing.

The Animating Idea: An Atlas of Intelligences

One way to meet these challenges would be to develop an "**Atlas of Intelligences.**" In brief, the proposal is to develop a dynamic reference work on diverse intelligences. This

would document and synthesize existing DI research, and support further cross-disciplinary work in this area. It would be of broad educational value, serving as a resource for students and educators across a range of disciplines and building capacity by helping a new generation of scholars navigate this emerging, cross-disciplinary field of study. It would also play a key role in disseminating cross-disciplinary DI research to scholars in related fields and to the wider public.

A first step is to determine whether there is enthusiasm and need for an Atlas of Intelligences among potential users, and to determine what features of such a resource would meet their needs. We conducted a scoping study to investigate these questions.

Key Areas of Investigation

To assess the interest in—and need for—an Atlas of Intelligences, the study investigated four key areas:

Area 1: The Existing Landscape

An Atlas of Intelligences would need to plug a gap in the existing landscape of resources devoted to DI research: it would need to satisfy an unmet need. To determine whether there is such a need, the study investigated the resource landscape in DI research as it stands, asking:

- What resources are currently used for exploring DI research, particularly when considering some key "use cases" for an Atlas of Intelligences? (Box 2)
- What are the limitations (if any) of the resources currently available?

Box 2: Some Key Use Cases

- **For researchers:** Understanding research in an unfamiliar topic or discipline.
- **For educators:** Finding readings suitable for assigning to students.
- **For students:** Understanding the background behind assigned readings.
- **For science communicators:** Contextualizing a newly published paper.
- **Wider public:** Exploring the research behind a news article in greater depth.

Area 2: Imagining the Atlas

If there is a gap in the resourcing landscape for DI research, a further question is how it ought to be filled. The needs and preferences of potential users should be considered when answering both the general question of what sort of resource to develop, as well as more specific questions about its content, structure, formats, and design.

The study investigated potential users' preferences about possible new resources, including:

- What types of new resources would be valued by potential Atlas users? For example, would they value a new encyclopedia-style resource modelled on the Stanford Encyclopedia of Philosophy? (Box 3)
- Do potential Atlas users have preferences about the structure, features, or design of a new resource?

Box 3: The Stanford Encyclopedia of Philosophy

One model that has been suggested for the Atlas of Intelligences is the Stanford Encyclopedia of Philosophy (SEP)—an open-access, scholarly, dynamic reference work in philosophy—which has achieved enormous success since its launch in 1995. It aims to achieve comprehensive coverage of topics in philosophy. Its entries, written and peer-reviewed by experts, provide balanced overviews of philosophical topics and are accessible to non-specialists. These entries are updated regularly, allowing them to adapt to new research developments. But each version of an entry has a stable URL and is citable in perpetuity. As well as being relied upon by philosophers, the SEP is a well-known resource beyond the discipline. Indeed, several participants in this scoping study with no background in philosophy gave the SEP as an example of a successful academic resource.

Area 3: Diverse Audiences

An important consideration in developing any resource is the intended audience. In principle, the target audience for an Atlas of Intelligences might include anyone with an interest in Diverse Intelligences research.

However, the population of people interested in Diverse Intelligences research is likely to be diverse. It would include those currently involved in DI research, as well as researchers in related disciplines, educators and students, science communicators, and the interested public. These groups may differ with respect to, among other things, their academic and professional backgrounds as well as their levels of interest in specific areas of DI research. Differences between potential user groups may present challenges to the development and success of an Atlas of Intelligences, as different user groups may have differing interests, vocabularies, and needs to balance.

To assess this, the study investigated the diversity of the target audience, asking:

- Do different user groups have different experiences of, or issues with, the existing resource landscape?
- Do different user groups have differing levels of interest in or preferences about a new resource?

Area 4: Operational Issues

The success of an Atlas of Intelligences would depend on both sustained financial investment and voluntary contributions of work and time. Financial resources would be needed to attract and retain qualified staff, and to meet other operational costs including web hosting and analytics. In addition, the resource would require effort from members of the DI community who would act as authors, editors, and reviewers, and who may help promote the Atlas within their networks.

Accordingly, the study explored two critical operational questions:

- How might the ongoing financial costs of developing and maintaining an Atlas of Intelligences be met?
- How might members of the DI community be incentivized to contribute to an Atlas of Intelligences?

Methods

We combined three methods to address these questions. First, we conducted interviews with editors and managers of existing resources that were similar in scope or ambition to the envisaged Atlas of Intelligences. These interviews were primarily intended to provide information relevant to questions in areas 2, 3 and 4. Second, we conducted a broadcast survey that was widely circulated to potentially interested groups. The survey was designed to collect evidence relevant to all four areas. Finally, we conducted semi-structured interviews with a range of potential users and contributors. These allowed us to collect more in-depth and granular information relevant to all four areas.

Interviews with resource editors and managers

We conducted 60-minute informal interviews with current or former editors (n=6) of the following resources:

- BrainFacts.org
- The Encyclopedia of Life
- Encyclopedia of the History of Science (ETHOS)
- Knowing Neurons
- Scholarpedia
- The Stanford Encyclopedia of Philosophy

In these interviews, we asked editors some contextual questions about the aims and scope of their resource. We also asked about their audiences; their financial model; their resource's structure, design, and future trajectory; their approach to balancing the needs of diverse audiences; and any operational challenges. We also briefly outlined the idea and motivations for an Atlas of Intelligences, and invited them to reflect on the project (for the interview guide, see Appendix A in the online supplementary material: https://bit.ly/3IV4Zvd).

Broadcast survey

In consultation with experts from a range of DI-disciplines and experts in mixed-methods and survey research—and drawing on what had been learned from informal interviews with editors—we designed a 15-minute broadcast survey (Appendix B).

The survey was pre-registered using the Open Science Foundation's OSF Registries (Appendix C), and underwent the ethical review procedure of the Department of Psychology at the University of Cambridge. It was hosted on Qualtrics, and distributed through multiple channels, including on social media; through mailing lists; on newsletters and listservs aimed at DI-related populations, both within and outside academia; and by asking participants to share the survey with others. The survey was anonymous.

The survey included:

- Basic demographic questions about participants' academic and professional background.
- Questions about participants' level of interest in various DI topics.
- Questions about the existing resource landscape: what resources they use, how they find them, and any challenges they have faced exploring DI research.
- Questions about what new resources they would like to see, what features they would value, and what financial models they would find acceptable.
- For respondents who were academics, questions about how likely they were to contribute to a new resource and about what might incentivize them to contribute.

Interviews with potential users

In parallel with survey data collection, we conducted 60-minute semi-structured interviews with a range of potential users and contributors. Interviewees all had backgrounds in DI-related areas, and were selected to represent a diversity of academic backgrounds, career paths (academic and non-academic), and career stages (from master's students to established professionals). The final sample size (n=17) was determined using the saturation method—that is, interviews continued until new themes and insights became scarce. The interview protocol underwent ethical review at the Department of Psychology at the University of Cambridge.

Using a semi-structured interview guide (Appendix D), participants were asked about:

- Their background and interest in DI research.
- Their experiences and level of satisfaction with existing resources.
- Their interest in and preferences about new resources, including questions about resource content, structure, formats, and design. Where appropriate, they were prompted using visual aids reflecting different approaches taken by existing resources.
- How people might be incentivized to contribute to a new resource.
- Whether and how the needs of diverse audiences can be balanced.

Results

283 respondents completed the survey and were included in our dataset. A further 205 surveys were initiated but excluded for one of three reasons: failure to complete more than one substantive question; implausibly fast completion time (<4 min); and non sequitur responses to optional text questions (the latter two features suggesting the survey may have been auto-filled). As some questions were optional and some permitted more than one response, the total number of respondents varies between questions.

Survey respondents reported expertise in the following disciplinary backgrounds (with some selecting more than one):

- **psychology, neuroscience or cognitive science:** 37% (n=105)
- **philosophy or history and philosophy of science**: 35% (n=99)
- **computer science or artificial intelligence**: 26% (n=73)
- **biology or biological science**: 24% (n=68)
- **anthropology or sociology:** 16% (n=45)

These respondents were drawn from a range of career paths and stages:

- **professional academics (post-PhD)**: 35% (n=100)
- **graduate students**: 25% (n=73)
- **undergraduate students**: 14% (n=41)
- **researchers outside a university setting**: 9% (n=25)
- **science communicators**: 7% (n=19)
- **teachers outside a university setting**: 5% (n=14)

In what follows, descriptive statistics from the broadcast survey are reported as they are relevant to the four key areas described earlier. These are presented along with themes and selected anonymized quotations emerging from interviews and from optional free-text responses to survey questions.

Area 1: The Existing Landscape

1.1 Which resources are currently used?

The first question we aimed to answer was: Which resources do people interested in DI research currently use most frequently? We were interested in two senses of the term "resources." The first is the **type of content** people like to use when consuming information about DI research. Peer-reviewed research articles were the most frequently used resource, with 58% (n=165) of respondents saying these were among the resources they used most often. 40% (n=113) said that they often used in-depth feature articles, 37% (n=106) used podcasts or videos, 34% (n=95) used online encyclopedia articles, 33% (n=92) pre-print research articles, and 29% (n=82) short news articles (see Figure 1).

Figure 1

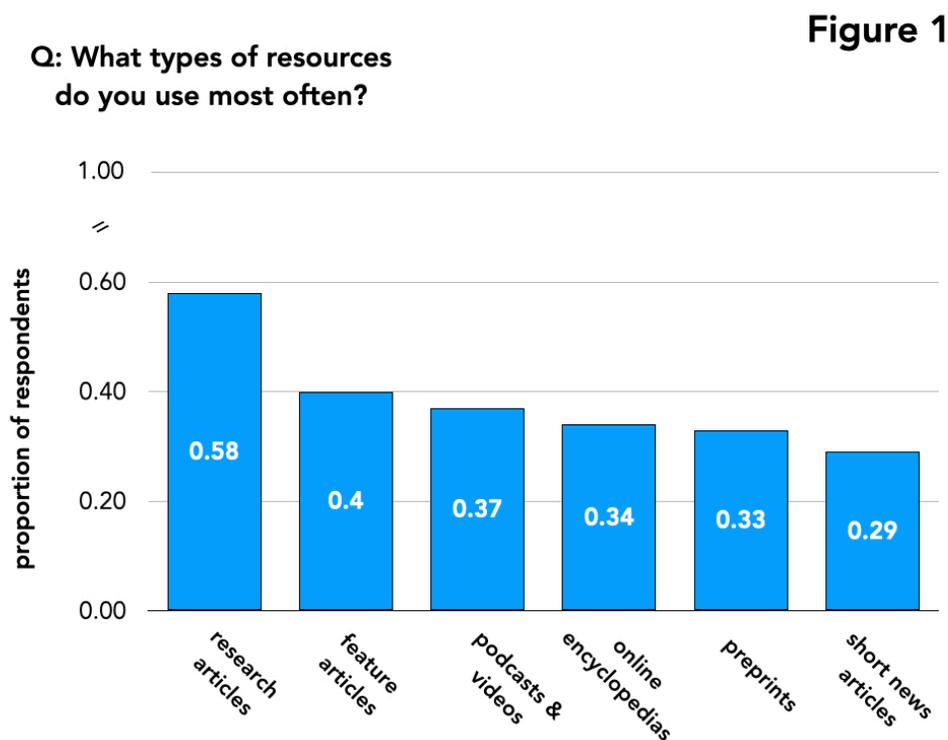Q: What types of resources do you use most often?

Figure 1. Responses to the question: "What types of resources do you use most often?" Respondents were free to select more than one answer.

The second sense of "resource" that we were interested in is the **tools that people use to find the content** they will eventually consume. Literature search tools such as Google

Scholar were the most common way to find information on DI topics, with 55% (n=157) of respondents reporting that they used these, followed by generic search engines, which were used by 45% (n=128). 33% (n=93) searched or browsed online encyclopedias to find information, with a similar number looking on social media (33%, n=94). 30% (n=85) subscribed to mailing lists or newsletters, 28% (n=79) asked for recommendations, and 6% (n=17) would go directly to specific websites (see Figure 2).

Q: How do you typically go about finding information on DI topics?
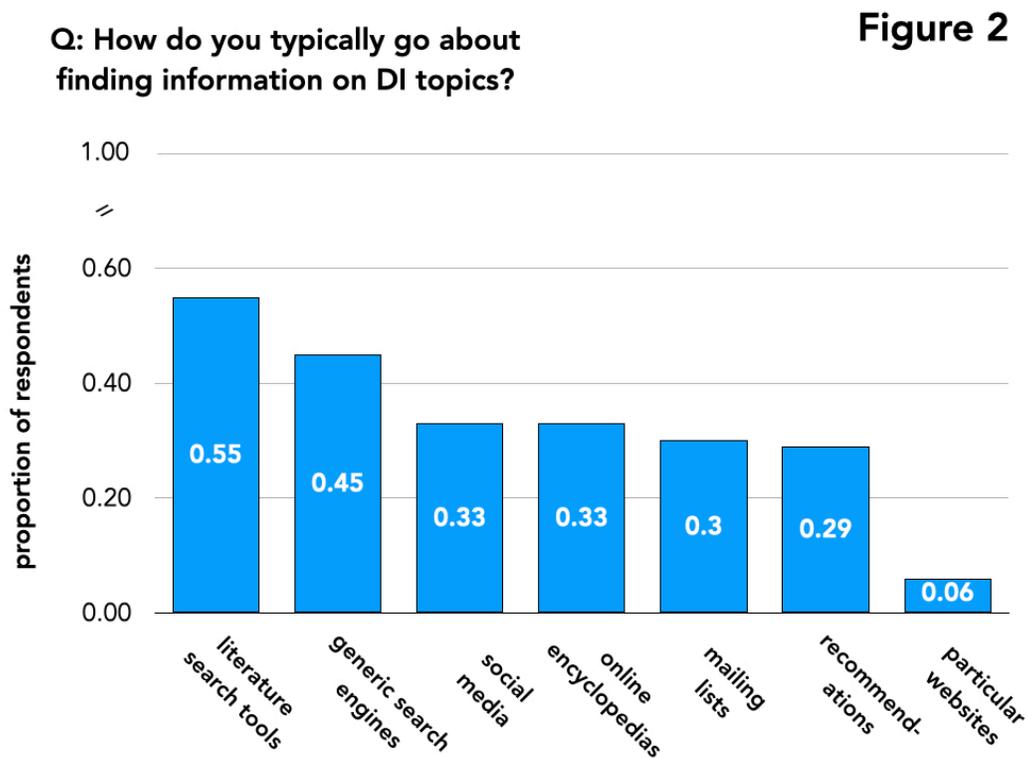
Figure 2

Figure 2. Responses to the question: "How do you typically go about finding information on DI topics?" Respondents were free to select more than one answer.

Echoing these survey results, most interviewees reported making extensive use of the primary research literature, and literature search tools like Google Scholar. When looking for accessible overviews of new topics, most interviewees would read recent review papers, especially for topics in cognitive science and adjacent disciplines, and follow the "citation trail":

"I would basically start looking for the most recent review on the issue and then try to see what they cite and what cites this review ... And then after a few hours of reading and searching, I would usually get to a point where I have an orientation about what to look for and what to read."

Some interviewees also mentioned reading textbooks, watching YouTube lectures, reading popular science magazines, and listening to podcasts. Almost all interviewees volunteered, without prompting, that they used the Stanford Encyclopedia of Philosophy:

"If it's a new concept or something that I've forgotten about, the SEP is an amazing resource."

"In philosophy the best resource by far, which I really think is an incredible resource, is the SEP."

In general, survey respondents are **looking for accessible overviews or in-depth information** when they explore DI research (accessible overviews: 58%, n=164; in-depth information: 54%, n=154). In addition, 37% (n=105) reported that they were generally looking for a specific piece of research, 34% (n=97) for information about the leading experts on a topic, and 4% (n=12) for something else. Similarly, many interviewees reported that they were often looking for an overview that would facilitate their understanding of the primary literature:

"I feel like to reach a place where I'm really interested, I feel like I need to understand the arguments, the kinds of conversations happening in a field, having some kind of reference point to ground the technical information to."

1.2 What are the limitations of existing resources?

We next aimed to determine whether there were limitations to the current resource landscape. Respondents reported that it was **hard to find resources synthesizing work from across disciplines**. Nearly half (47%, n=127) reported that it was difficult or very difficult to find work from across disciplines collected in one place, with only 24% (n=65) finding this easy or very easy. Similarly, nearly half of respondents (48%, n=130) found it

difficult or very difficult to find out how work from across disciplines fits together, whereas only 25% (n=67) found this easy or very easy.

By contrast, survey respondents found it **easy to find specific pieces of research**. 46% of respondents (n=125) said that it was easy or very easy to find specific pieces of research, with only 19% (n=51) finding this difficult or very difficult. Similarly, respondents found it **relatively easy to find in-depth information** about a topic, though slightly less so than specific pieces of research—with 39% (n=106) finding this easy or very easy and 28% (n=77) finding it difficult or very difficult (see Figure 3; note that here and elsewhere numbers reported in the text include responses of "don't know," whereas figures exclude these).
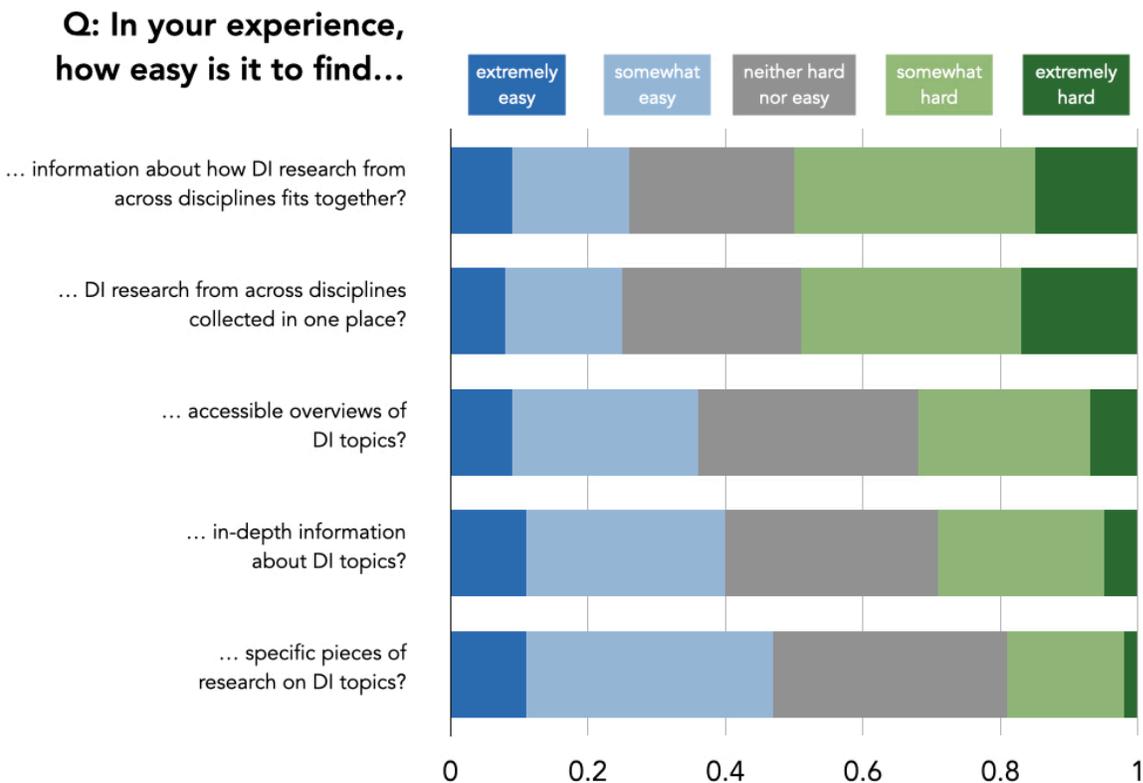

Figure 3. Responses to the question: "In your experience, how easy is it to find..." Responses of "don't know" were excluded from the graph.

Respondents' experience of **finding accessible overviews was more mixed**, with similar numbers reporting that this was easy or difficult (extremely/somewhat easy: 34%, n=93; extremely/somewhat difficult 31%, n=85).

Free text responses and interviews indicate several possible explanations for this variability. First, respondents and interviewees suggest that finding accessible overviews is easier within one's area of expertise than it is in other disciplines. One respondent reported "not knowing where to begin if it's a completely new field." **Differing terminological conventions** across fields were a common obstacle here. As one person put it:

> *"You might think that there **must** be research on some topic, but then you use the key words from your home discipline and nothing comes up. Only once you learn the vocabulary of the related disciplines can you effectively search."*

As well as being a barrier to effective search, many respondents and interviewees highlighted differing terminological conventions as an obstacle to understanding, increasing the risk of "cross-talk." For example, one interviewee related that they had spent a long time investigating research on communication in another discipline, only to learn later that "communication" had an entirely different meaning in that field.

Second, several individuals reported that where accessible overviews in other fields are available, it can be difficult to find ones **pitched at the right level**. As one respondent put it, "'clickbait' or 'fun fact' articles dominate Google searches, and even more serious magazines or podcasts do not go in depth." However, research articles are pitched to field experts and "too difficult for me to read." Interviewees reflected on a similar problem:

> *"Published works in AI research are often really difficult for people who don't have computer science training to make sense of … DeepMind always puts up a blog post when they publish some major paper. Those go too far the other way … There's a lack of explanations which are pitched at people who are disciplinary outsiders but want to actually understand how the thing works."*

"[Many encyclopedia entries are] too superficial. I know what the 'confirmation bias' is. I'm not trying to find out what the 'confirmation bias' is. I'm trying to find out what is the research, what have people done on the confirmation bias? Where is the research at? That's what I'm trying to find out."

One editor also highlighted that there was an **underexplored niche** to be filled here, saying that there was a need for "an authoritative source of factual information" that sits between a storytelling-focussed approach (which is optimized for the general public) and relatively inaccessible research tools (which are optimized for on-the-ground researchers).

Finally, the **quality and reliability** of overviews can be uneven, and difficult to judge in unfamiliar fields. Several interviewees highlighted that encyclopedia overviews can be excessively long and of variable quality; review articles, meanwhile, can be excessively partisan. It can be difficult to distinguish "idiosyncratic views" from "consensus views" when looking at new topics. For some, this relates to questions about the expertise of the authors. As one interviewee put it, there is a "question of authenticity: how do you know that these people are good?"

Box 4: Key Outcomes

- A wide range of resources are currently used, with peer-reviewed resources and search-dedicated tools being the most popular.
- It is difficult to find resources that synthesize work from across disciplines and help users navigate connections between fields.
- Finding relevant, reliable, accessible overviews of research outside one's own discipline is a challenge.

Area 2: Imagining the Atlas

2.1 What new resources would be valued?

Figure 4
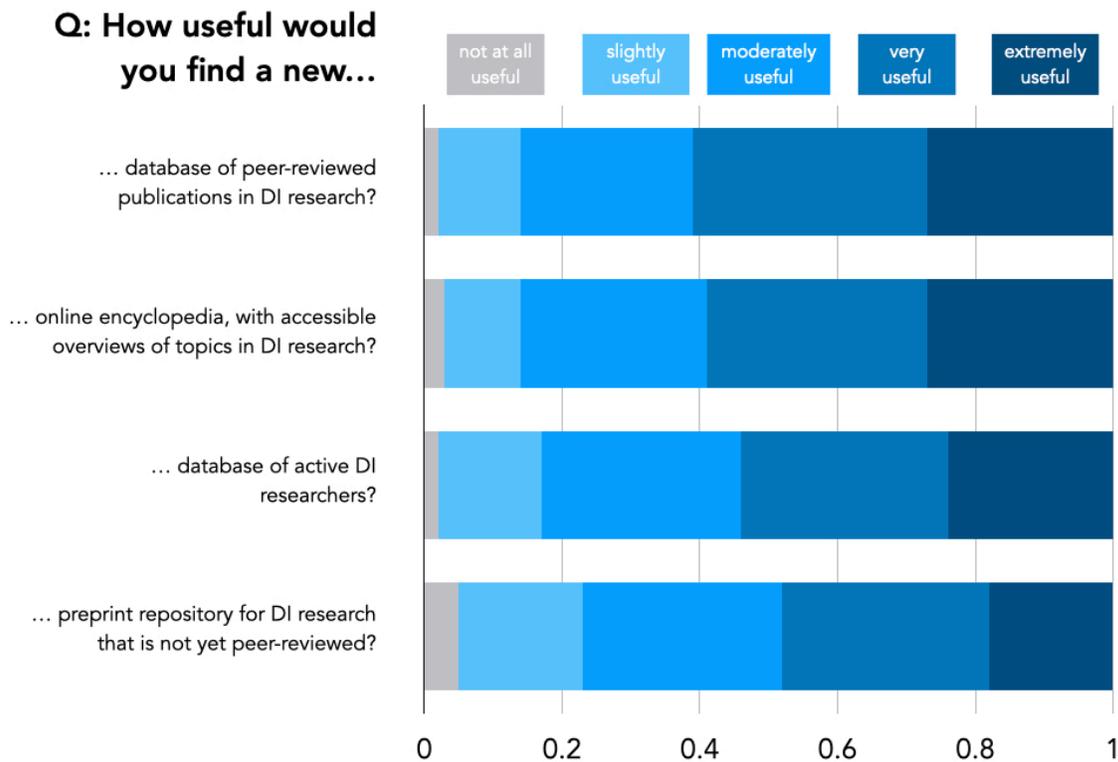
Figure 4. Responses to the question: "How useful would you find a new..." Responses of "don't know" were excluded from the graph.

We next aimed to understand what new resources potential users were most enthusiastic about. The majority of survey respondents would value a **new database of DI publications**, with 61% (n=161) saying that they would find this very or extremely useful, and with only 14% (n=37) saying that it would be slightly or not at all useful. Similarly, 58% (n=154) said that they would find a **new encyclopedia** providing accessible overviews of DI topics very or extremely useful, and only 13% (n=34) describing it as slightly or not at all useful. There was also considerable interest in a **database of DI researchers**. 54% (n=142) of respondents said that this would be very or extremely useful,

while 17% (n=44) said that it would be slightly or not at all useful. A pre-print repository was a less popular option, with 48% (n=127) saying that this would be very useful or extremely useful, but 23% (n=60) describing it as slightly or not at all useful (see Figure 4).

The preference for article databases, encyclopedias, and researcher databases over preprint databases was reflected in respondents' views about the best sources of accessible overviews. For this purpose, respondents suggested that the most useful resources were peer-reviewed articles (extremely/very useful: 56%, n=149), conversations with colleagues (extremely/very useful: 54%, n=145), and encyclopedia articles (extremely/very useful: 48%, n=127). Pre-print articles were generally viewed as less useful for this purpose (extremely/very useful: 38%, n=101), as were magazine or news articles and blogs (extremely/very useful: 36%, n=95): and podcasts or videos (extremely/very useful: 40%, n=108) (see Figure 5).

Q: When you want an accessible overview of an area of DI research, how useful do you typically find…

Figure 5
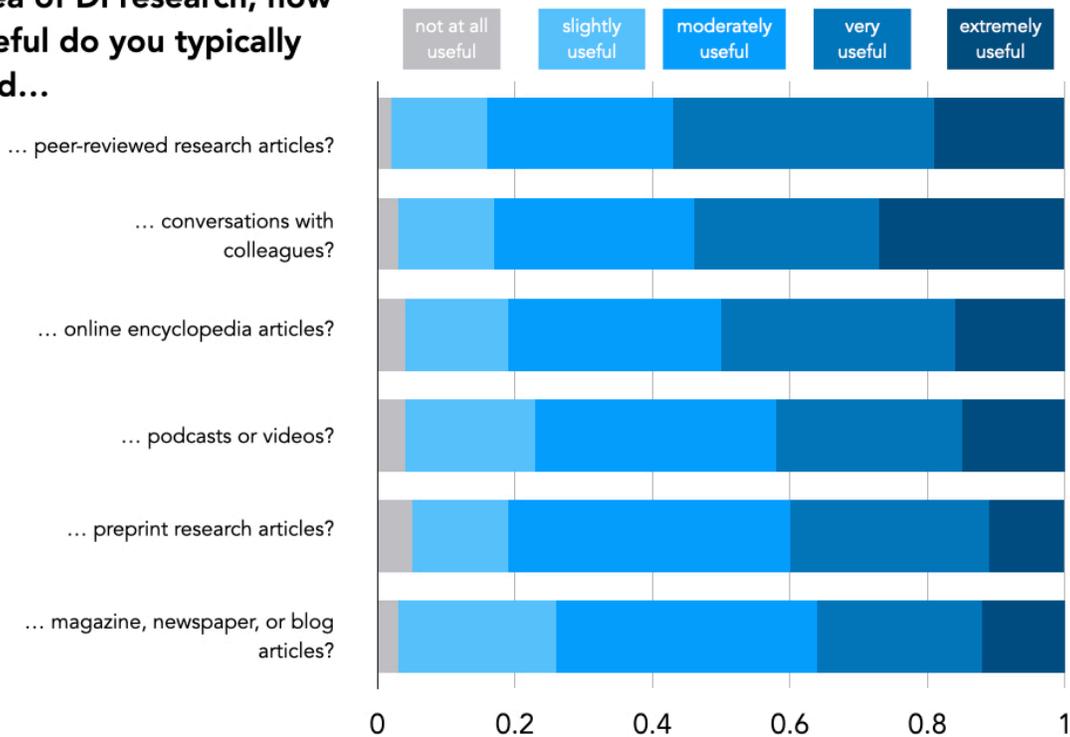
Figure 5. Responses to the question: "When you want an accessible overview of an area of DI research, how useful do you typically find…" Responses of "don't know" were excluded from the graph.

Similarly, both interviews and survey participants' free-text responses indicated broad support for three kinds of new resource.

First, **an encyclopedia-style resource**, providing accessible overviews of DI topics:

"It would be very good to have something like [the Stanford Encyclopedia of Philosophy] for animal cognition, or for cognition more generally across different organisms."

"Like a Wikipedia of intelligences."

The particular use cases envisaged for an encyclopedia-style resource were cases in which both academics and non-academics wanted to find out about the state of research

in unfamiliar disciplines or to learn about the connections between disciplines, as well as cases in which academics were planning teaching or looking for readings to assign to students:

"There's a very interdisciplinary question which is like, 'What does progress in machine vision have to do with our understanding of human and animal vision?' … [It] would be super helpful for somebody in my position to … have access to a summary of the current state of the art on a question like that."

"I could see it being really useful to be able to do almost like a map of those debates. I guess, 'that's the conversation happening within the field and how they relate to other conversations with other fields.' To be able to see more of the structure of what's going on."

"I think it's also great for undergraduates and any kind of teaching as well. It's a really easy way into understanding the complexities of the topic without having to deal with the primary literature and all of the mess that goes along with that."

Second, a resource **organizing and curating existing work** in DI, providing users with a structured guide to a topic or field—as one interviewee put it, "a starter pack of reading":

"I think an Atlas of Intelligence would be great to have, that would say … 'This was when the concept was first introduced and this is … a timeline of the research and these are some of the debates.' Then, 'Here are links to papers that are representative of the different areas in the debate.'"

"I'd like to be able to type in "binding problem," have a little spiel that says, 'Here's this related thing in neuroscience about synchrony, here's this related thing in psychology … here are some ways that people have thought about it in philosophy relating to propositional compositionality or something.' So then I get the links and maybe for each of those entries I would have a couple of papers or review articles … They're not going to cover all the bases, they're not going to represent all views in the field. But they kind of give you a center of gravity in the field from which you can then build up."

Both prospective users and editors of existing resources highlighted the advantages of a **curation model**, in which a new resource selects from existing content that has been developed elsewhere. This avoids "reinventing the wheel," by repeating work which has already been done elsewhere, and it also builds the usefulness and visibility of the new resource more quickly.

But as one interviewee put it, "there is curation and there is curation … it isn't just dumping everything in a box." Given the challenges associated with finding the correct search terms, interviewees suggested there might need to be multiple ways of finding or sorting information. For instance, one interviewee proposed that information should be sortable according to various features, including experimental paradigms, labs, and species. Several suggested that there would need to be a way of translating between the "index terms" used in different disciplines.

Some interviewees proposed a hybrid approach, in which new content providing accessible topic overviews is combined with structured guides to existing literature.

> *"Something which was simultaneously the Stanford Encyclopedia of Philosophy and the Oxford Bibliographies … Written down, citeable overviews, but also organized, so it's structured pieces, so it's easy to find the section which is most likely to answer the question that I've got. Then, yes, lots of useful references but hopefully that kind of Oxford Bibliographies thing where it gives you a little idea about what's included in each of the further reading suggestions."*

Finally, a resource **building cross-disciplinary engagement and community**, for instance by providing up-to-date information about conferences, project calls, academic networks and research groups.

> *"I have students who are interested in working with cetaceans and I don't have resources of people who are working with killer whales … I think it would be great to have a database of, yes, researchers, especially people who would be willing to have interdisciplinary engagement, visitors, students coming into their lab."*

"There are some conferences in other disciplines that I just have found out about ... [It] didn't come up because my network doesn't go to this particular conference."

Since information about researchers, projects, and conferences could in principle be contributed by the community, incorporating a space for this in a new resource might be a relatively low-cost way to boost engagement. Some survey respondents also suggested that additional online community elements such as comments or forums would be valuable. However, others suggested that this could damage the authoritativeness of the resource as comments "can be written by anyone." Editors of existing resources also cautioned that these features can be unpredictable and intensive to manage.

2.2 What content, structure, formats, and design are preferable?

We next examined what potential users would want a new resource to look like—in terms of content, structure, formats, and design.

2.2.1 Content

In general, survey respondents indicated that **being comprehensive, up to date, peer reviewed, and written by experts were important** features in a new resource. Each of these features was considered very or extremely valuable by at least 60% of our respondents, while 10% or less described these as slightly or not at all valuable. 56% (n=148) said that accessible language was very or extremely valuable, with only 12% (n=31) saying that it was slightly or not at all valuable. Academic endorsement was also valued—although somewhat less highly, with 49% (n=129) considering it very or extremely valuable, and 22% (n=58) valuing it slightly or not at all (see Figure 6).

Interviews with prospective users reflected similar values. Interviewees stressed that it is important for a resource to be **recognized as authoritative**: "being authoritative and being accepted as a research tool, those things are very important for me." Endorsement by academic institutions was mentioned as one indicator of authoritativeness: "I mean, Stanford Encyclopedia—one thing that comes to mind is Stanford." So were peer review and an editorial board of recognizable experts with "star power."

Q: How valuable would you find the following features in a new resource?

Figure 6

Legend: not at all valuable | slightly valuable | moderately valuable | very valuable | extremely valuable

Categories (top to bottom):
- Comprehensive coverage of major topics in the field
- Kept up to date with the latest research
- Content written by leading experts
- Peer reviewed by experts
- Accessible language, clear to non-experts
- Endorsed by academic organizations

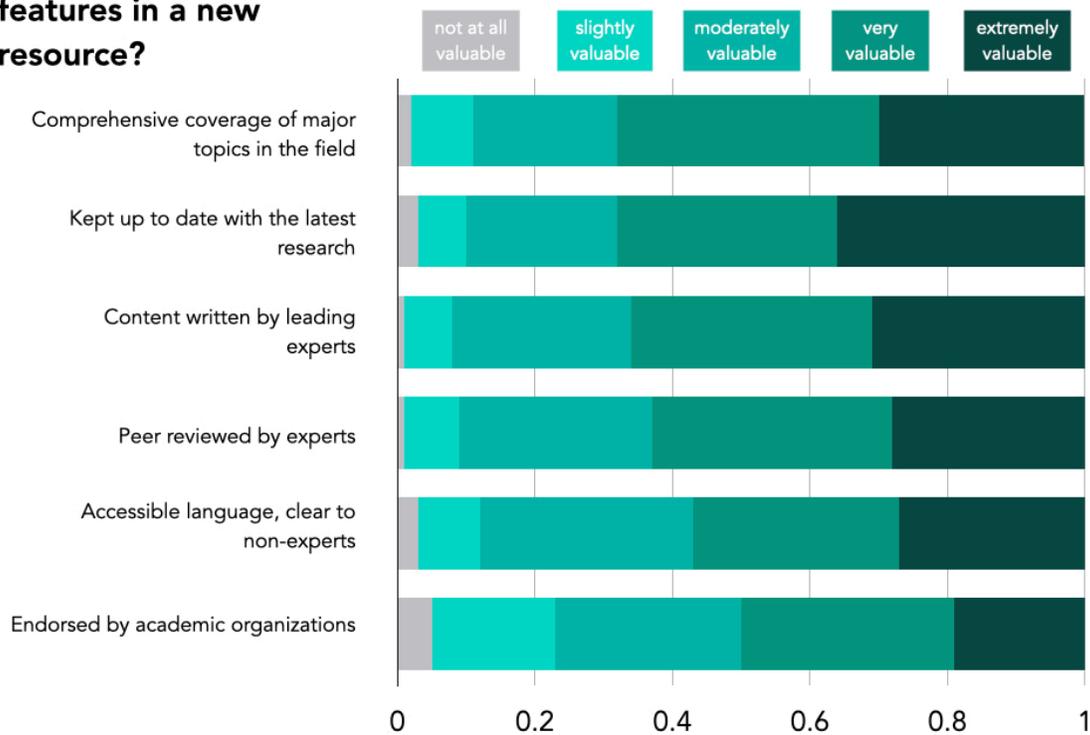X-axis: 0, 0.2, 0.4, 0.6, 0.8, 1

Figure 6. Responses to the question: "How valuable would you find the following feature in a new resource?" Responses of "don't know" were excluded from the graph.

Interviewees agreed that articles should be written by experts, generally characterizing an expert as a scholar in the field who has published on the topic, including relatively early-career academics: "A postdoc would count." In fact, several expressed the view that **early-career authors might be preferable** in many cases:

"I think authority figures are not, necessarily, more reliable when it comes to writing these sorts of things, because they often don't have the time to stay on top of the literature … So I would actually trust a competent postdoc more with that sort of task."

"I think as far as seeing what is coming or seeing what is at the cutting edge, I do think that [early-career scholars] have an advantage … I think they will do a better job … They are more likely to try to be balanced about it.'

Interviewees also stressed the importance of keeping the content up to date: "it would have to be **updated fairly regularly.**" Some stressed that it would need to be transparent *how* up to date it was, and what updates had taken place, or else researchers might have less confidence in using the content:

"Was this like an update that happened in 2012 where the person … added in a few new references? Was it fully rewritten?"

Finally, several interviewees highlighted length as an important consideration, with a **preference for concision**: "I wouldn't want to dig through twenty pages of text"; "I just need some overview to give me a brief summary"; "I think that they should be on the shorter side, because you want these things to save you time."

2.2.2 Structure

Several interviewees proposed that a resource should have **a two-level structure**, in which brief topic overviews direct the reader to more targeted in-depth information:

"You could have a hierarchical structure … You could imagine having a TL;DR ['too long; didn't read'] for each of the areas or the subjects, and then branching out into more detail."

"I want it to be more like expert Wikipedia, where it's like here's the little nugget if I'm trying to pull a definition … Then there could be a 'click to learn more' and then you get the 8,000 extra words."

One interviewee proposed that this two-level structure would provide a way to **integrate curation and encyclopedia-style models**, as well as helping to get a new resource established more quickly:

"At the beginning, you may only have four or five overview articles and then you might have like a bunch of links out. And I think over time, in-house things, like

as more things get written … you are going from something that is just like a hub to something that is pulling things into itself … You can't just say, 'We are going to start the Stanford Encyclopedia of Philosophy today.' You can't."

Both interviewees and editors generally cautioned against trying to impose a more complex hierarchical structure than this: "If you try to organize things into any kind of tree-like structure, there will be disagreements." However, making it possible to follow **links between related topics** or entries was considered important.

"You can follow your way through the links and there may be a background assumption about the ontology and the way that things interlink but … it's not imposing that it needs to be hierarchical or circular or chronological, it's not imposing anything. It's just saying, 'this links to these things.'"

2.2.3 Formats

Figure 7

Q: How valuable would you find the following features in a new resource?

| not at all valuable | slightly valuable | moderately valuable | very valuable | extremely valuable |

Images / graphics

Datasets

Videos / animations
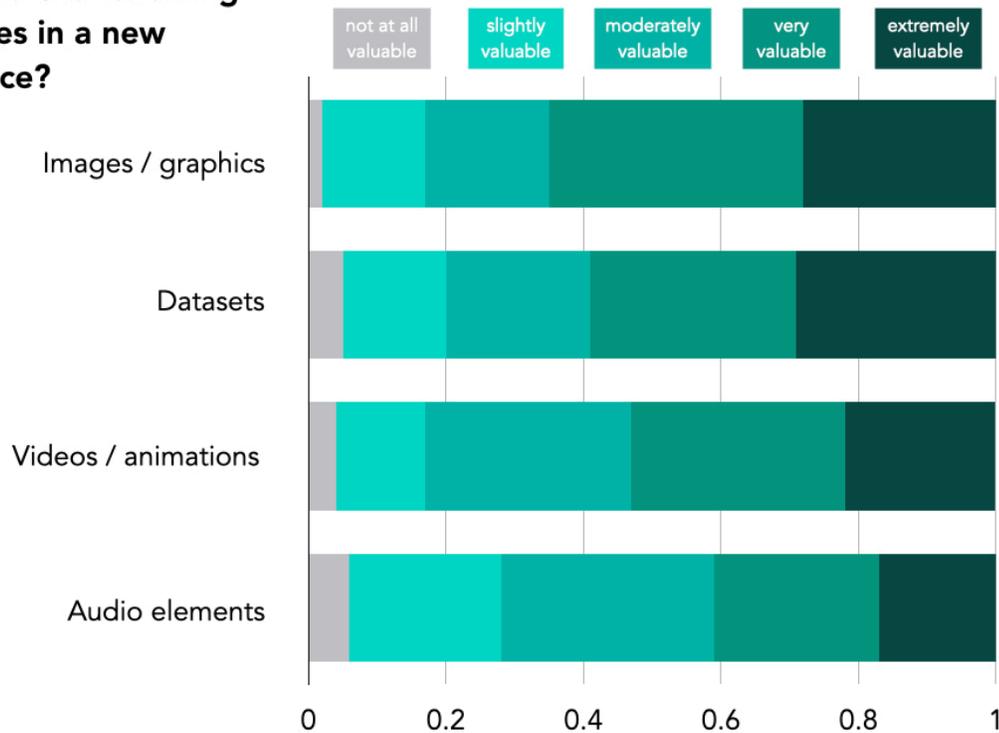
Audio elements

0   0.2   0.4   0.6   0.8   1

Figure 7. Responses to the question: "How valuable would you find the following features in a new resource?" Responses of "don't know" were excluded from the graph.

Survey respondents generally thought **non-textual formats would be valuable**. Images or graphics were considered the most useful, with 65% (n=171) saying that they would be very or extremely valuable, and only 17% (n=44) describing them as slightly or not at all valuable. Many would also value having access to datasets from studies in the field, with 58% (n=153) describing this as very or extremely valuable, and only 19% (n=51) describing it as slightly or not at all valuable. Videos and animations were also considered valuable, with 52% (n=136) finding them very or extremely valuable, and 16% (n=43) finding them slightly or not at all valuable. In contrast, 41% (n=107) said that audio would be very or extremely valuable, with 27% (n=72) describing it as slightly or not at all valuable (see Figure 7).

Several interviewees stressed that **getting the text right should be prioritized** over the integration of alternative formats.

> *"It seems to me the key thing is getting the text-type information in the right format, that it's right, it's correct so that it accords with what you'd find out if you could ask a specialist, and its reasonably short … The text thing is going to be key."*

> *"In general I think what's much more important is how the logic of the text is structured … Give me a well-written text without figures any day over a badly written text with all the figures."*

However, most agreed that alternative formats could be valuable if used carefully: "I think that visuals and multimedia would be super valuable if you wanted to see a video from an experiment, or an image that's describing a paradigm or a photograph of a behavior"; "I'd probably say that [videos of experimental procedures and behaviors] would be more helpful than some guy explaining something in front of a green screen." Some indicated that "explainer" style videos would be more helpful for students or from a teaching perspective than from a research perspective. One editor indicated that multimedia and interactive elements often drove higher engagement with their resource:

> *"If I'm looking to answer a question so that I can write a paragraph, then I'm not going to watch a 10-minute video about it. But if I'm looking to show my students something about some debate and there's a nice, balanced video that explains both sides and it goes for 5 minutes, then I'd probably show that."*

However, several editors cautioned that multimedia elements, especially video, had drawbacks. In particular, **videos can be difficult to revise and keep up to date**, and formats are likely to change and become obsolete, meaning that video is associated with higher creation and maintenance costs.

One survey respondent also highlighted that videos and animations can pose **problems for accessibility**, and can make websites unusable for people with some disabilities. It would be important to consider accessibility at every stage in the design of a new resource, including in decisions about the use of multimedia formats.

2.2.4 Design

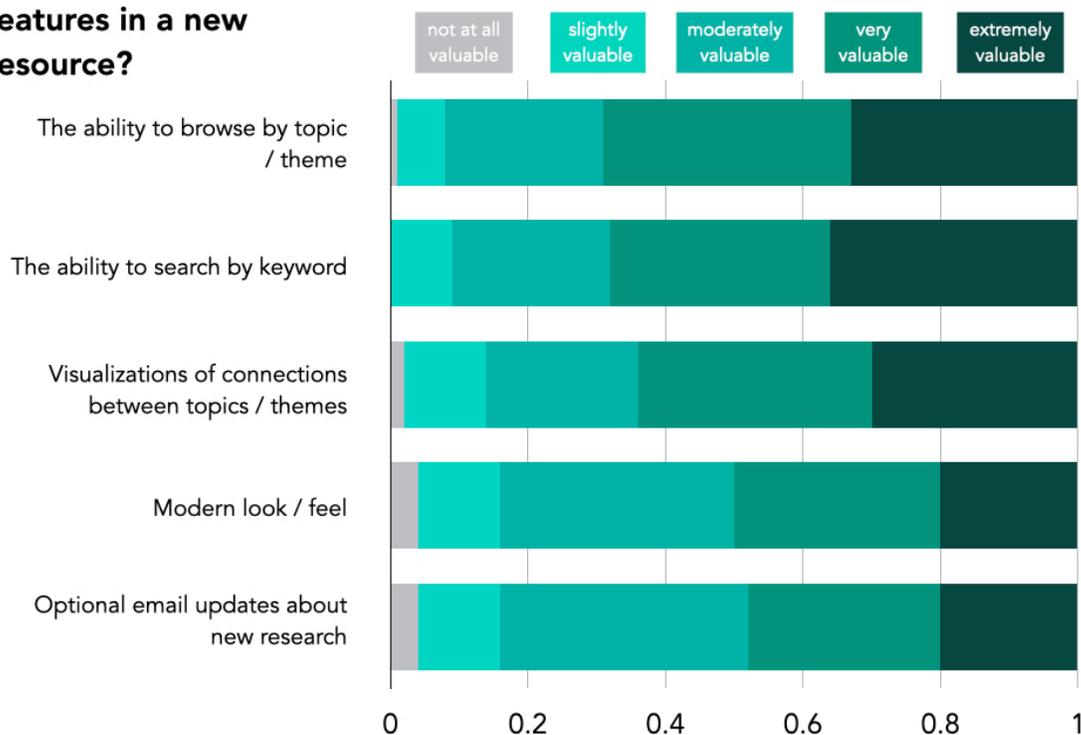Q: How valuable would you find the following features in a new resource?

Figure 8

Figure 8. Responses to the question: "How valuable would you find the following features in a new resource?" Responses of "don't know" were excluded from the graph.

The **ability to browse** by topic or theme was considered valuable, with 68% (n=179) saying that it was very or extremely valuable, and 8% (n=20) considering it slightly or not at all valuable. Similarly, a good **search function** was considered important in a new resource, with 68% (n=179) describing this as very or extremely valuable, and only 8% (n=22) describing it as slightly or not at all valuable. A **modern look and feel** was also valued, though somewhat less highly, with 47% (n=124) describing it as very or extremely valuable. Similarly, **optional email updates** were considered very or extremely valuable by 49% (n=129) of respondents (see Figure 8).

Survey respondents also responded positively to **visualizations of connections** between topics or themes—as done in tools like Connected Papers (see example in Figure 9)—

with 63% (n=165) finding this very or extremely valuable, and only 13% (n=35) finding it slightly or not at all valuable. Several interviewees also suggested that this would be a useful feature:

Figure 9. An example from Connected Papers, showing the articles mostly closely connected to a 1970 paper by Gordon Gallup titled "Chimpanzees: Self-recognition." Image source: https://bit.ly/3qPxUuG.

"I'm a big fan of Connected Papers… I could definitely see that working."

"Something that I would find particularly useful is to get something similar to what they have in the Connected Papers website … that gives you a kind of network of, you know, who first started working on this topic and how did the rest emerge surrounding it."

"The network visual metaphor is so powerful and helpful."

"That gives you quite a tangible sense of how big topics are and how small topics are and how strong the connections are. I quite like exploring things that way."

Hyperlinks between related entries were also considered important as a way to facilitate exploration: "I think it's useful if there are **links within the body of the text** to the key words that lead you to other entries, so that you can very easily go down the rabbit hole if you want to pursue a particular topic."

In addition, several interviewees proposed that a **dynamic front page** would be valuable, with featured articles spotlighting topics in the news or on which there have been recent updates. As well as "putting some life" into the resource, this would facilitate discovery of new topics or ideas for both researchers and students: "I could tell a student, 'Hey, check out memory because there's a lot of new stuff coming out about memory that might be interesting to explore as a thesis topic.'"

Box 5: Key Outcomes

- Potential users would value new resources that provide accessible overviews, offer links to curated sets of existing resources, and help build community.
- New resources would need to be regularly updated, comprehensive, written and reviewed by experts, and have good search functionality.
- Non-textual resources and visualizations of topic connections would all be highly valued.

Area 3: Diverse Audiences

We next sought to understand how a potential Atlas could meet the needs of the different groups that have interests in DI research. The two groups we were most interested in were those involved in academic research and those who are not. We classified survey respondents who identified as professional academics, graduate students, or researchers outside a university setting as "academics," and those who identified as science communicators or journalists, teachers outside a university setting, or undergraduate students as "non-academics."

3.1 Do user groups have different outlooks on the existing landscape?

There were some unexpected differences between academics' and non-academics' outlooks on existing resources. Overall, academics had more difficulty finding resources which synthesize work from across disciplines. 53% found it somewhat or extremely difficult to find out how work from across DI disciplines fits together, compared with 35% of non-academics. Similarly, 51% of academics found it somewhat or extremely difficult to find work from across DI disciplines collected in one place, compared with 34% for non-academics. Academics found accessible overviews more difficult to find, with 36% finding this somewhat or extremely difficult, compared with 19% of non-academics. Similarly, they found it more difficult to find the leading experts on DI topics (somewhat/extremely difficult: 49% of academics; 30% of non-academics).

One possible explanation for these differences is that academics and non-academics may have differing views on what "counts" as an accessible overview, an expert, and so on. One piece of evidence that might point in this direction is that **academics found magazines, newspapers, and blogs less useful** when it comes to finding accessible overviews, with 33% finding these very or extremely useful, compared with 43% of non-academics. Another possibility is that academics are more cautious in their judgments about when they have found an overview or an expert because the question carries greater risk for them: the costs of being wrong may be somewhat higher for academics than non-academics. Evaluating these possibilities would require further investigation.

3.2 Do user groups have different preferences about a new resource?

Academics and non-academics had **similar levels of interest in a new encyclopedia**, with 59% and 56% respectively saying that this would be very or extremely useful. This was, indeed, the resource that most appealed to both groups.

Non-academics were less interested than academics in a **database of peer-reviewed publications**. 46% of non-academics said that this would be very or extremely useful (compared with 66% of academics), while 24% of non-academics said that this would be only slightly or not-at all useful (compared with 10% of academics). Similarly, non-academics were less interested than academics in a **database of researchers**: 44% said that this would be very or extremely useful (compared with 57% of academics), while 23% said that it would be slightly or not at all useful (compared with 14% of academics) (see Figure 10).
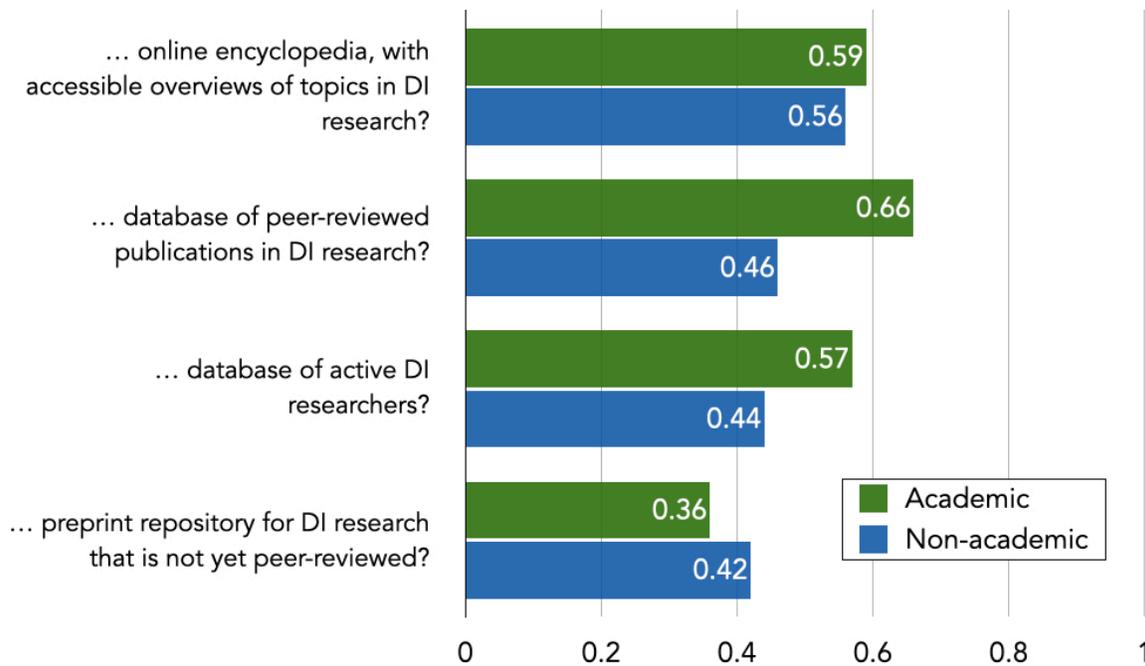
Figure 10

Q: How useful would you find a new…

Figure 10. Comparison of academics' and non-academics' responses to the question: "How useful would you find a new…" Bars show the proportion of respondents describing a given option as very or extremely useful.

Non-academics were likely to place **greater value on videos and animations** than academics, with 59% saying that they would be very or extremely useful (compared with 49% of academics). But they rated the value of images less highly than academics, with 58% saying that these could be very or extremely useful, compared with 69% of academics. This may suggest that, despite its drawbacks, investing in video content may be an important way to draw in a wider audience. Non-academics also placed a **higher value on optional email updates**, with 59% saying this feature would be very or extremely valuable, compared with just 46% of academics. Incorporating this into an Atlas might be a relatively low-cost way to drive non-academic engagement (see Figure 11).

Figure 11

Q: How valuable would you find the following features in a new resource?

Images / graphics
- Academic: 0.68
- Non-academic: 0.58

Videos / animations
- Academic: 0.49
- Non-academic: 0.59

Optional email updates
- Academic: 0.46
- Non-academic: 0.59
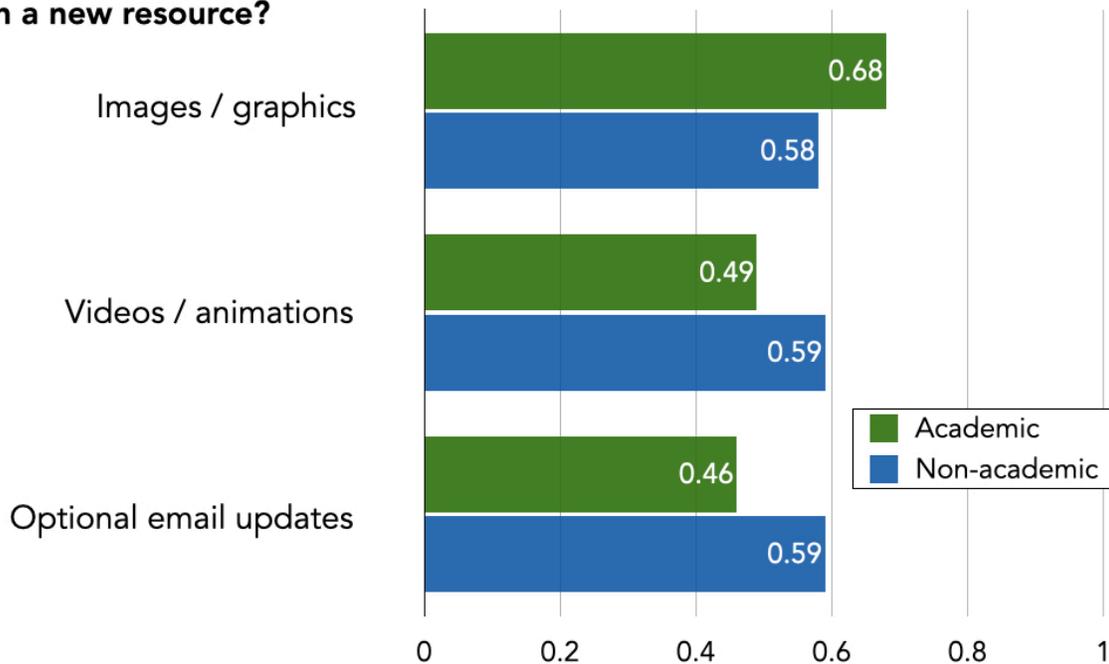
Legend: ■ Academic ■ Non-academic

Figure 11. Comparison of academics' and non-academics' responses to the question: "How valuable would you find the following features in a new resource?" Bars show the proportion of respondents describing a given feature as very or extremely valuable.

Academics placed a **higher value on expert authorship and peer-review, as well as being comprehensive and current**. 70% of academics said that expert authorship was very or extremely valuable, compared with 51% of non-academics, and 66% rated expert peer review as very or extremely valuable, compared with 52% of non-academics. Similarly, comprehensive coverage of the field was very or extremely valuable to 71% of academics, compared with 58% of non-academics. And only 7% of academics said that being kept up to date with the latest research was slightly or not at all valuable, with 17% of non-academics saying the same (see Figure 12). Interviews confirmed that these were important signals by which academics would judge the quality of a resource.

Figure 12

Q: How valuable would you find the following features in a new resource?

Kept up to date with the latest research — Academic: 0.69, Non-academic: 0.61

Comprehensive coverage of major topics in the field — Academic: 0.71, Non-academic: 0.58

Content written by leading experts — Academic: 0.7, Non-academic: 0.51

Peer reviewed by experts — Academic: 0.66, Non-academic: 0.52

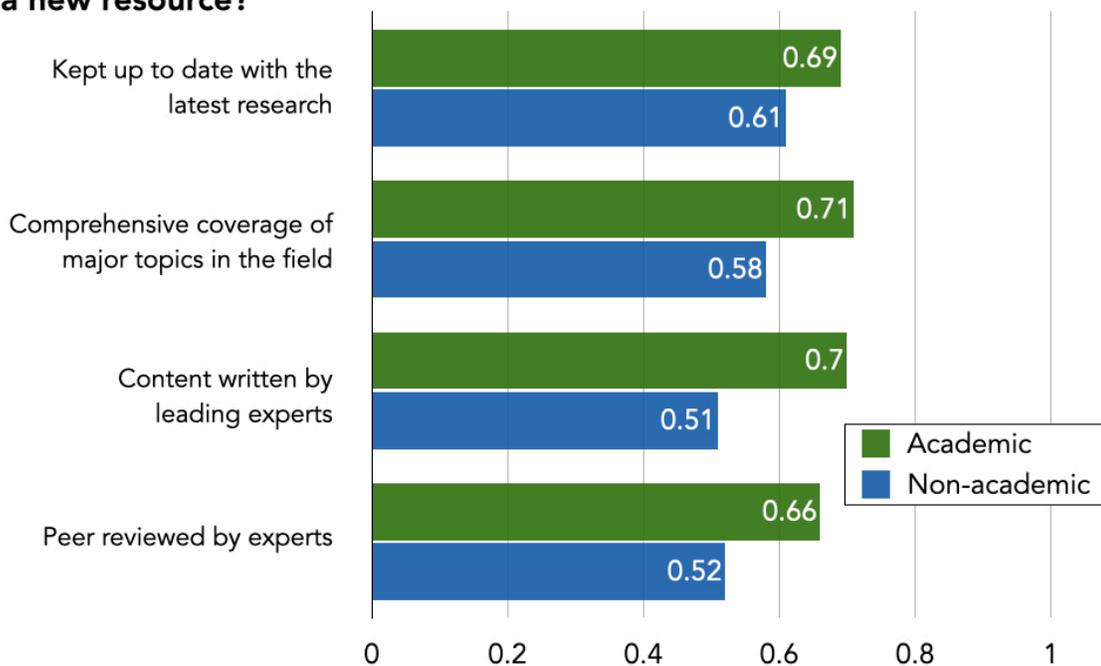Legend: Academic (green), Non-academic (blue)

Figure 12. Comparison of academics' and non-academics' responses to the question: "How valuable would you find the following features in a new resource?" Bars show the proportion of respondents describing a given feature as very or extremely valuable.

Interviewees were sensitive to the challenge of successfully targeting a resource at diverse audiences. As one put it, "the more emphasis you put on being useful to one group, then the less useful the thing will be for any of the other groups." However, most interviewees resisted the idea that there was any fundamental tension in targeting a resource at both academic and non-academic audiences, expressing the view that **accessible information is good for everyone**:

"There is quite a lot of snobbish approach … of thinking that 'Oh, we need to make it really easy and accessible for the general audience.' And it is forgetting that everyone enjoys reading something that is easy to read, that is simple, that is clear, that doesn't use jargon every two sentences and have five acronyms."

"It's very easy to slip into making these oversimplifications in order to make it appeal to the public, and then it becomes less of a good resource for the scientist … It's underestimating the public's intelligence."

"You are making it accessible to undergrads, you are making it accessible to people who might have ADHD or autism or be dyslexic. You are making it accessible for mums that cannot … spend two hours reading a paper."

Box 6: Key Outcomes

- The type of resource with the broadest appeal to both academics and non-academics was an encyclopedia.
- All potential users prize non-textual content, such as images, but non-academics are more enthusiastic about videos.
- Compared to non-academics, academics would place higher value on content written and reviewed by experts.

Area 4: Operational Issues

We next sought potential users' views on various operational issues involved in putting out an Atlas of Intelligences, beginning with the issue of whether some financial models were preferable to others.

4.1 Which financial models are preferable?

Survey respondents generally **felt positive toward resources that were free** and asked for donations from users, with 59% (n=155) feeling somewhat or extremely positive and only 11% (n=29) feeling somewhat or extremely negative.
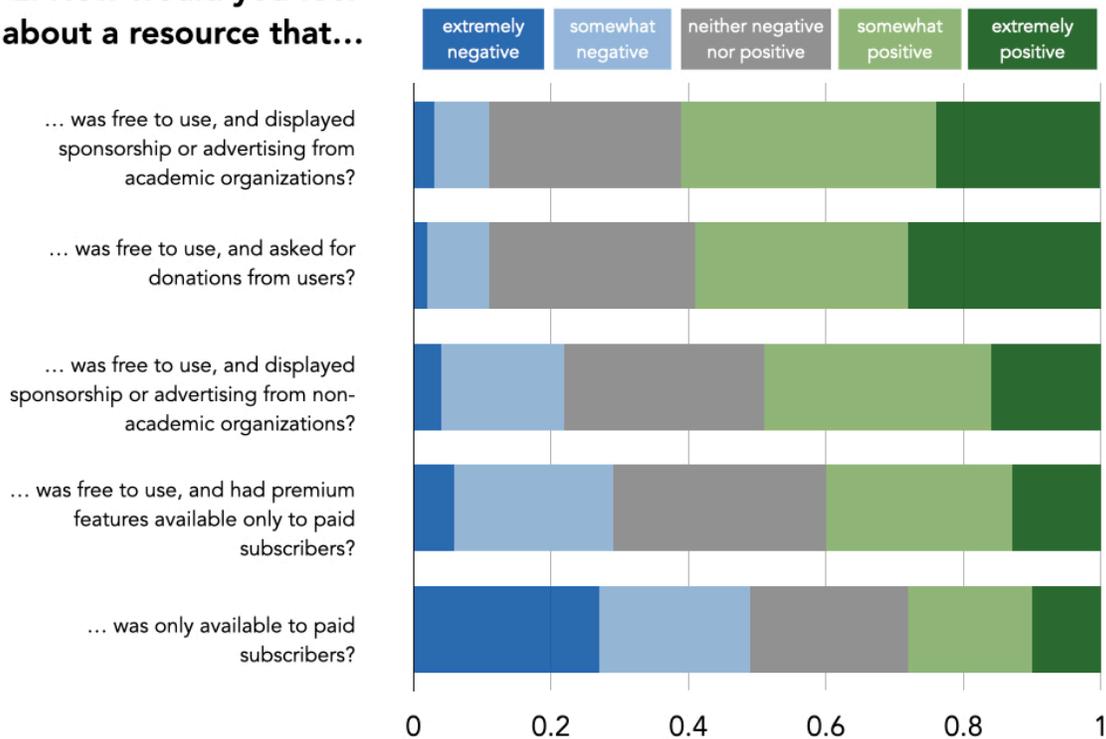

Figure 13. Responses to the question: "How would you feel about a resource that..." Responses include academics and non-academics; responses of "don't know" were excluded from the graph.

Free resources that displayed **sponsorship or advertising from academic organisations were similarly well-received**, with 61% (n=161) feeling somewhat or extremely positive and 11% (n=28) somewhat or extremely negative. Free resources displaying non-academic sponsorship or advertising were a less popular option, with 49% (n=129) feeling somewhat or extremely positive and 21% (n=56) somewhat or extremely negative. The preference for academic over non-academic sponsorship was pronounced among the academics in our survey, with 66% of academics feeling positively about academic sponsorship, compared with 46% feeling positively about non-academic sponsorship (see Figure 13).

Putting all content behind **a paywall was unpopular**. Only 27% (72) felt somewhat or extremely positive toward this option, with 49% (n=129) feeling somewhat or extremely negative. This was driven by the academics in our survey, 56% of whom reported feeling somewhat or extremely negative towards a paid subscription model. **Non-academics felt more positively** toward this model, with 31% feeling negatively, and 36% feeling positively. Negative feelings toward paywalls were echoed by respondents in their free-text responses to other questions, as well as by our interviewees: as one interviewee put it **"a paywall is a huge issue."** Several interviewees highlighted this in the context of concerns about the exploitative nature of traditional academic publishing and the movement toward Open Science.

> *"Quite apart from the actual principle there is an aesthetic vibe of Open Science that is important, I think, to capitalize on. And so I think any attempt to make it subscription based or anything like that is probably not going to work."*

40% (n=104) of survey respondents felt positively toward a "freemium" model, in which a free resource has some additional features only available to paid subscribers. Again, non-academics were more receptive to this approach, with 56% feeling positively toward freemium models, compared with 34% of academics. One possible explanation for this difference is that academics would likely be using a new resource for work purposes, and so might be less willing to pay for additional features than individuals using the resource for leisure.

On the whole, respondents reported that access to high-quality PDFs, high-resolution images or infographics, a members-only online community, members-only events or an

ad-free experience might make them more likely to subscribe, on a freemium model. However, **no features were particularly strong incentives to subscribe**. In particular, academics were not particularly swayed by these incentives, with the exception of an ad-free experience: 43% of academics reported that this would probably or definitely make them more likely to subscribe, with 31% saying that it probably or definitely would not. Additional features seemed more incentivising for non-academics—in each case, 40-50% of non-academics indicated that they would be more likely to subscribe in exchange for these features (see Figure 14).
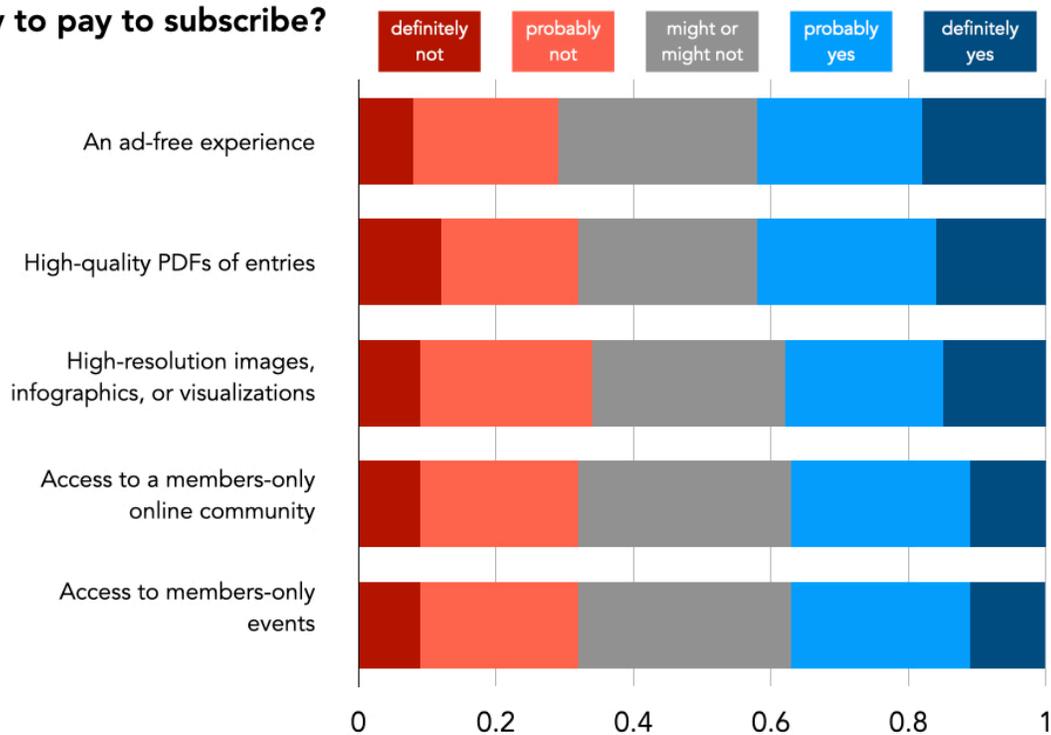

Figure 14. Responses to the question: "If a resource offered additional features to paid subscribers, would the following additional features make you more likely to subscribe?" Responses include academics and non-academics; responses of "don't know" were excluded from the graph.

Most of the resources whose editors we interviewed had received grant funding. Several reported that this had presented challenges, in particular finding ways to secure ongoing

funding when initial "start-up" grants expire. Two resources had open-ended funding commitments from government or grant-awarding bodies that enabled them to continue operating, but had lost most of their initial sources of funding. As a result, one had transitioned into "maintenance mode," reducing both the size of their staff and the scope and scale of their resource.

The Stanford Encyclopedia of Philosophy achieved **financial sustainability** by creating an endowment, made up of donations, grant funding and funding from university libraries. The income from this endowment supplies the majority of the encyclopedia's operating budget. This is an attractive model, although the editor of a resource founded more recently reported that it was very difficult to secure funding from libraries and universities. It is worth noting that the Stanford Encyclopedia of Philosophy sought **specialist advice** when establishing their model, using grant funding to retain both a business consultant and a fundraising consultant.

4.2 How might contributors be incentivized?

Q: How likely would you be to contribute in the following ways?

Figure 15

Legend: definitely not | probably not | might or might not | probably yes | definitely yes

Categories: Sharing entries with students, Authoring entries, Reviewing entries, Serving as an editor
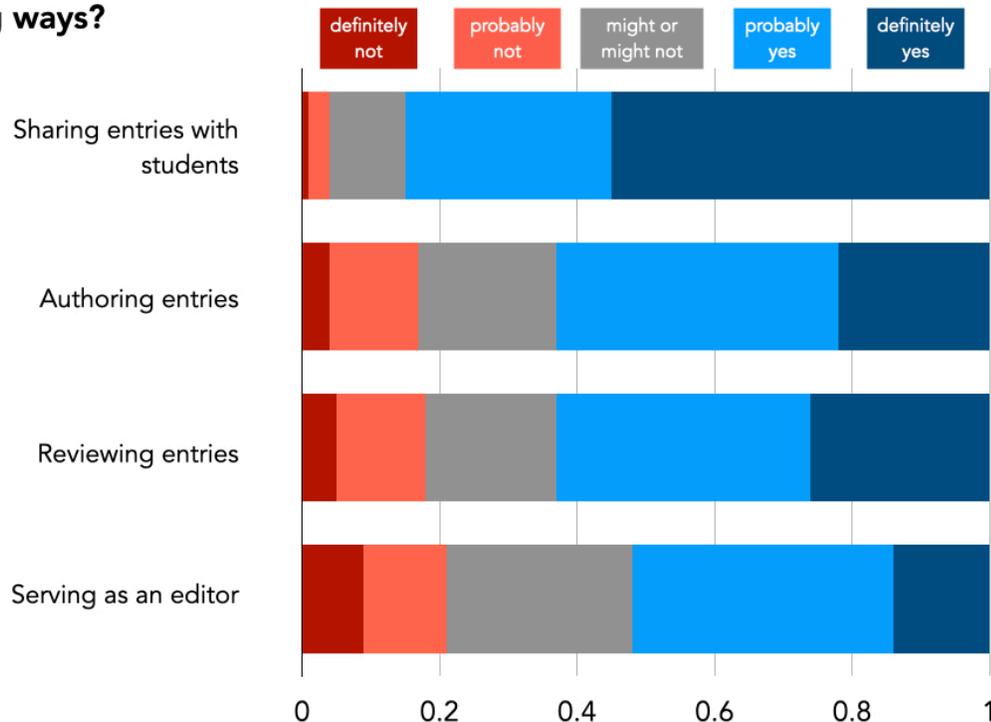
X-axis: 0, 0.2, 0.4, 0.6, 0.8, 1

Figure 15. Responses to the question: "As an academic, how likely would you be to contribute to a new, open-access resource for DI Research in the following ways?" The question was only displayed to academics; responses of "don't know" were excluded from the graph.

Most academics in our survey reported that they **would be likely to contribute** to a new resource by authoring and reviewing entries. 64% (n=63) said that they would be somewhat or extremely likely to author entries, with only 17% (n=17) saying that this was somewhat or extremely unlikely. Similarly, 64% (n=63) said that they would be somewhat or extremely likely to review entries, with 16% (n=16) saying that this was somewhat or extremely unlikely. Around half said that they would be somewhat or extremely likely to act as an editor (53%, n=52), while 21% (n=21) said that this was somewhat or extremely unlikely. 85% (n=84) said that they would be somewhat or extremely likely to share entries with students and colleagues (Figure 15).

68% (n=67) of academics said that they would be more likely to contribute to a resource if contributing gave them **opportunities to network** with other contributors. 54% (n=53) said that they would be more likely to contribute in exchange for modest **financial compensation**, and 58% (n=57) said **public acknowledgment** of their contribution would make them more likely to contribute. Access to special features would make 41% (n=41) more likely to contribute, with 32% (n=32) saying that this would not increase their likelihood of contributing (Figure 16).
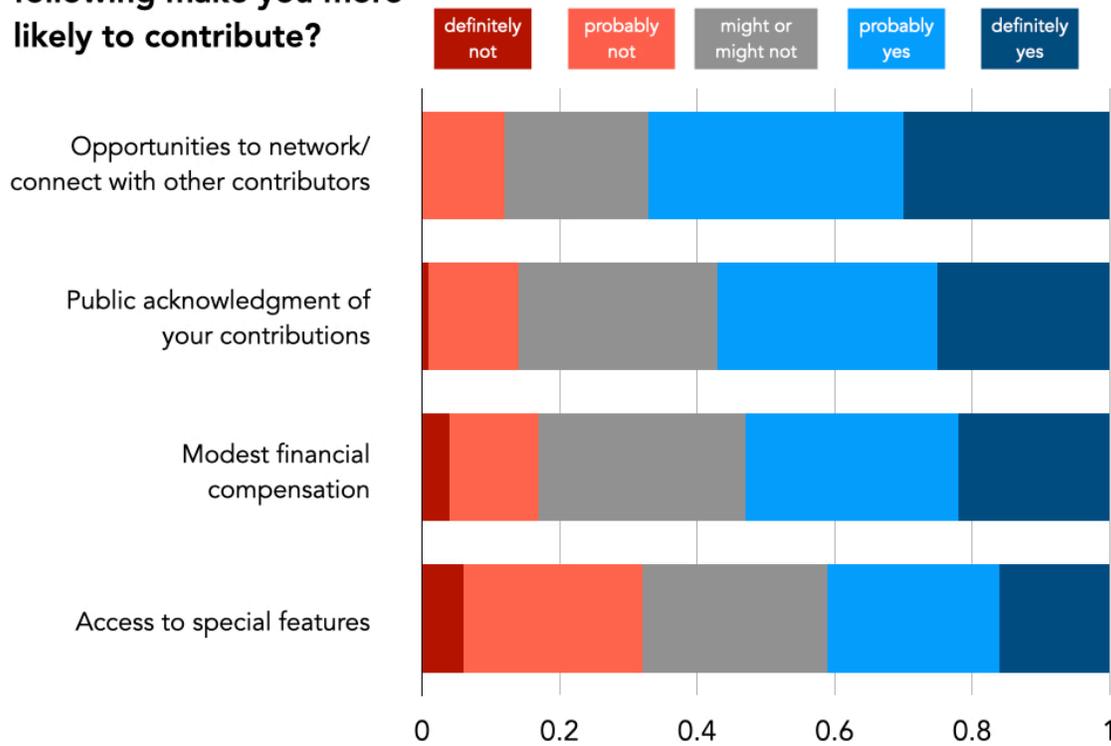

Figure 16. Responses to the question: "Would the following make you more likely to contribute in any of the ways mentioned above?" The question was only displayed to academics; responses of "don't know" were excluded from the graph.

Academic interviewees agreed that academics would in general be willing to contribute to a new resource. It was noted that **early-career scholars were more likely** to be

motivated to contribute. As one established academic said, "there is almost nothing anyone could do to get me to write something I didn't want to write."

Prestige or reputation would be an important factor in motivating people to contribute to a resource, presenting a "chicken and egg" problem: "It's quite a hurdle to get to the point where … people want to do it because they know that lots of people are reading it." Markers of academic quality and reliability such as peer review were mentioned as important factors here, as was having **influential figures** in the field visibly involved in the project:

> *"The key thing for me would be just perception that this is something which has recognition among the group of people who are leaders in the specific field … So having those kinds of influential leaders involved in some way, yes, would make a difference."*

Editors agreed that establishing prestige would be important, saying that it helps to have recognisable figures "championing" the resource, such as by sitting on its editorial board. One interviewee highlighted that this presents a special challenge in the case of the Atlas: Since it is envisaged as a cross-disciplinary resource, it would require the involvement of leading figures from across disciplines.

Interviewees agreed that financial compensation might incentivize contributors, though some expressed skepticism that "you could afford the financial incentives which would be big enough to make a difference to the number of people that you'd need." Interviewees felt that **networking** would be a powerful motive. One suggested inviting contributors to a conference at which multiple contributors would present sketches of their articles, suggesting that including some "big name" contributors would make this incentivizing. One interviewee said that this was the only thing that would incentivize them to contribute, and one editor reported that they had used this approach successfully when establishing their editorial board.

Finally, interviewees felt that **a paywall would be a counterincentive** to contributors:

> *"If this was a pay to use thing, I would be much less inclined to donate my time to produce material for it."*

4.3 Other outcomes

Editors stressed the importance of **consistent leadership with a firm vision**. Some felt their resources had suffered from a regular turnover of editors and a lack of clear direction. Some editors also emphasized the importance of having a **leadership team,** since concentrating the leadership of a project in too few individuals exposes it to a significant risk of failure if those individuals move on. Particularly where volunteers are involved, editors highlighted the importance of **setting clear expectations** and policies about responsibilities and deadlines.

Building engagement with a new resource is a significant challenge. As one editor said, "there is no way of making people look at your website." One interviewee proposed that **using crowdsourcing in the creation and development** of the resource would be key to getting it established. One suggestion was to conduct a large-scale survey of DI disciplines, asking about the important topics and index terms in each discipline and the links between them, and use this in developing the website. As noted above, this might also motivate incorporating a section in which the community can post information about researchers, conferences project calls and so on. Editors also advised **hiring social media specialists** to build engagement.

Editors stressed that it can be very difficult to know who is using a resource, and whether it is reaching the intended audience. They advised setting clear priorities and investing in good **web analytics** from the beginning:

> *"There is work before, when you commission: Who do I want to reach? What topic do I want to have discussed and why? … Then there is the publicising: let us put that in front of the right audience. What are the best ways to do that? And then there is the assessing of did people find it? Did people read it? … There is a lot of strategy around building content that has nothing to do with the actual content and I think it is picking your battles as well, like, what is the priority for you?"*

An important choice point will be choosing a **backend platform** for the resource. A key question here is whether to build one from scratch or customize something ready-made. The Stanford Encyclopedia of Philosophy built their own backend platform. This has the

advantage of being completely customizable, so they have been able to include features which increase the efficiency of their editorial process which might not otherwise have been available. **Most editors advised using an existing platform**. One editor said that the most important thing they had learned from experience was "not to build your own stuff if you can possibly avoid it"; another cautioned against "reinventing the wheel"; a third highlighted that using a ready-made platform had reduced costs since, though they had to pay a programmer to customize it initially, they do not need to keep programmers on staff.

Box 7: Key Outcomes

- Potential users were positive about all models in which the majority of content would be free to all users.
- Most academics signaled interest in contributing to the Atlas.
- The strongest incentive for academics to contribute would be to feel that they were contributing to a worthwhile endeavor, with leading figures visibly involved.

Vision

Based on the findings described above, there appears to be broad enthusiasm for an Atlas of Intelligences—in particular, for an encyclopedia-style resource that makes Diverse Intelligences research easier to find, understand, and integrate. The findings also point to features of such an Atlas that would best serve the needs of diverse user groups. While some of the challenges and implementational choices faced by a project of this scope require further study, in what follows we propose a vision of the Atlas that we think would best respond to users' needs and enthusiasm.

At the most general level, the Atlas would need to be **free to use, enriched with visuals and other non-textual materials, written in accessible prose, and kept up to date**.

The Atlas we propose would feature **two main types of content**. The first would be **high-level overviews** of relatively broad, cross-cutting topics (~1000 words). These would be **written by in-house staff, would appear without bylines,** and would be accompanied by **annotated bibliographies** highlighting key works in the area. The second main type of content would be **in-depth articles** on relatively narrow topics (~3000-6000 words). These articles would cover particular constructs, experimental paradigms, theoretical frameworks, and phenomena of note. They would be **written by experts in the field (with a byline), peer-reviewed,** and would be followed by a **standard academic reference section**. Both types of articles would include multimedia content and a closely curated set of outbound links to additional resources.

Box 8: Two article types for the proposed Atlas

High-level overviews:

- 1000 words (approx.)
- treating broad topics
- written in-house (no by-line)
- annotated bibliographies
- multimedia content
- curated outbound links

In-depth articles:

- 3000-6000 words (approx.)
- treating relatively narrow topics
- written by experts (with by-line)
- standard academic reference list
- multimedia content
- curated outbound links

An extended example will help better illustrate these types of content and how they fit together. Consider an overview on **Tool Use.** Such an overview would concisely characterize how tool use has figured in debates about, e.g., brain size, human evolution, and cognitive sophistication in non-human animals. This overview would be cross-linked with neighboring overviews on topics such as Culture, Human Evolution, Technology, and more; it would also cross-link to a number of in-depth articles on specific topics related to Tool Use. These might include detailed treatments of, e.g., the Physical Intelligence hypothesis, Meta-Tool Use, and Cetacean Culture. A reader interested in visualizing this network of topics (in the style of Connected Papers) could do so, with overviews and in-depth articles both represented in the network but graphically distinct.

As mentioned, one of the in-depth articles that might be linked to a Tool Use overview might be a piece on **Cetacean Culture**. This treatment would integrate a range of theoretical observations and naturalistic phenomena, and might include a rich array of multimedia content. It might, for instance, include a series of audio recordings illustrating dialectal differences in the songs of humpback whales. It might include a video of bubble net feeding. And it might include a sequential illustration of the phenomenon of sponge-carrying in dolphins (see Figure 17).
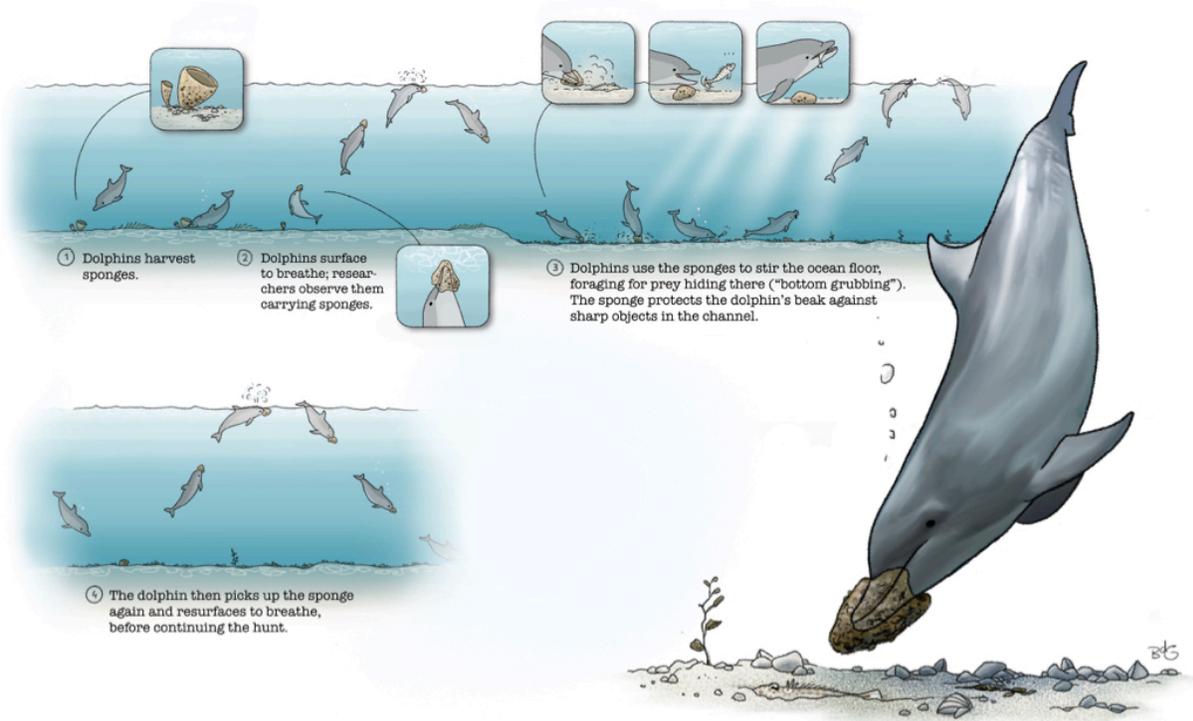
Figure 17

Figure 17. A sample figure as it might appear in the Atlas of Intelligences, depicting the phenomenon of sponge-carrying in dolphins. Illustration by Brenda de Groot.

These two article types are complementary: the high-level summaries would be geared toward disciplinary outsiders and non-academics who need a quick orientation to a large topic area; the in-depth articles would be geared toward academics and others (e.g., journalists) seeking comprehensive treatments with details about specific research findings and debates. Both would be written in accessible prose; vetted by reviewers; and regularly updated. Necessary technical terms would be linked to a **sitewide key terms** glossary, which would clarify how these terms are used in different disciplines. Timelines for updating would depend on the material treated: articles on some topics, such as emerging AI techniques, would require regular updating, whereas articles on other topics, such as behaviorism, may require updates less frequently.

A critical feature of the Atlas—and one that would require further prototyping with prospective users—is its user interface. Our findings indicate it would be ideal for the Atlas to afford both **search**—that is, targeted tracking down of desired information—and **exploration**—that is, undirected browsing of content that looks interesting. Search boxes on all pages, a table of contents, and annotated bibliographies would all facilitate search. Hyperlinks between articles, featured articles on the front page, and visualizations of connections between articles would facilitate exploration.

Another feature of the Atlas that will prove critical to its success is its perceived prestige and legitimacy. In order to solve the "chicken and egg" problem, the Atlas would require the **backing of venerable academic institutions**, an editorial or advisory **board with notable "star power,"** and a **founding set of articles** by top-flight contributors. In the early phases of the project, **visible events**—perhaps at major international conferences—promoting the Atlas would be key.

Our findings also inform certain practical aspects of running the Atlas. Essential to the project would be a **stable, committed team of editors** with subject matter expertise and a strong commitment to clear writing. It would also be important to involve team members with expertise in: graphics, video, and visualizations; audience engagement and analytics; and fundraising (at least initially).

In addition to the main website, a successful Atlas would also have a **lively social media presence**. This could serve to advertize new content (and newly updated content); highlight engaging visual elements of the Atlas; share events and opportunities relevant to Atlas users; and provide a platform for continued community building surrounding Diverse Intelligences research. A related feature of interest might be an email newsletter digesting the same sorts of content for those not on social media.

Given these operational demands, a successful Atlas would minimally require a team of **three full-time in-house staff** (or the equivalent mix of full-time and part-time staff). This stable team could be supplemented with other personnel on a contract basis to help with, e.g., initial web design and fundraising.

Several further details of the proposed Atlas—on particulars from the reference style to the funding model—remain to be explored. And, importantly, no one version of an Atlas of Intelligences would be able to meet at all the needs of those interested in Diverse

Intelligences research. But the version of the Atlas just sketched could fill an important gap in the current resource landscape; offer a resource of tangible and enduring value to a wide swath of users; and continue to catalyze community and intellectual exchange among those interested the world's many manifestations of intelligence.

Conclusion

As the Diverse Intelligences funding initiative enters a new chapter, questions arise about the legacy of the project: How might the findings from this ambitious effort be consolidated, integrated, and disseminated outside of the academy? Will the community that has sprung up around DI research live on after the initiative concludes? With these questions in view, one idea that has been proposed is to produce an Atlas of Intelligences—that is, an encyclopedia-like resource covering topics in Diverse Intelligences research. We conducted a scoping study to gauge enthusiasm and need for such a resource, and to get input from potential users on what it might look like in terms of content, structure, formats, and design.

Data from our broadcast survey and expert interviews suggested broad enthusiasm and need for something like the Atlas—in particular, for a resource that collects disparate strands of research on DI topics in one place, that highlights how this research fits together, and that provides accessible overviews of particular topics. Though different user groups are interested in slightly different features, it is not hard to envisage a version of an Atlas that would be greeted enthusiastically by a diverse set of users—both academic and non-academic—interested in DI research.

As with any ambitious effort, the Atlas project is not without challenges. These include the challenge of producing, soliciting, and curating content that is accessible across disciplinary boundaries; the challenge of incentivizing top-flight contributors; the challenge of assembling a core Atlas team with the varied expertise required; and the challenge of finding and implementing a funding model that is sustainable over the long term. More study is needed to identify the best ways to meet these and other challenges, but the present study highlighted several promising possibilities.

If these challenges were met, the value of such an Atlas would be considerable. It would offer a way to capitalize on and consolidate the successes of the Diverse Intelligences initiative. It would offer an enduring, accessible resource for all those—across disciplines and career stages—interested in the phenomenon of intelligence in its diverse manifestations. And it would help ensure that DI research continues to catalyze collaboration, fire curiosity, stoke insight, and expand people's worldviews for years or decades to come.