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Community attitudes TOWARDS science and technology in Australia

Key findings

- While different studies give different figures, there is generally a high level of interest and trust in science in Australia.
- Institutional trust is easier to gauge than general trust in science, due to the differing understandings of just what science is exactly, amongst the general public, and CSIRO is generally the most trusted science institution in Australia – although that is declining a little over time.
- The impact of negative media coverage on organisations or streams of science that are trusted or generally thought of favourably is minimal.
- The single most common source of information on science and technology is "just in passing" as part of general news media.
- Television remains the most popular single medium for getting information on science and technology across Australia, while online information is favoured by those with a high interest in science and technology.
- Segmentation studies show that up to 40% of the general population are unengaged or uninterested in science.
- Younger people are becoming increasingly unengaged on science, and this is a global trend in developed countries.
- Attitudes to science at school are a major predictor of attitudes to science later in life.
- People's attitudes to science, and applications of science, are significantly driven by people's values towards science and technology, and the world around us.

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1

So what do the general public really think of science?

There have been several significant polls into public attitudes towards science or technology undertaken in Australia over the past few years, which, when taken together, provide an increased understanding of the complexity of getting a simple answer to this question.

In 2010 the Australian National University (ANU), for example, published a study on people's attitudes to science that headlined with the finding that Australians are more interested in science than in sport. The study found that 90% or more of those interviewed (1,200 people by random phone poll) stated they were *Very or moderately interested in new scientific discoveries* – while approximately 70% were *Very or moderately* interested in sports news (ANU, 2010).

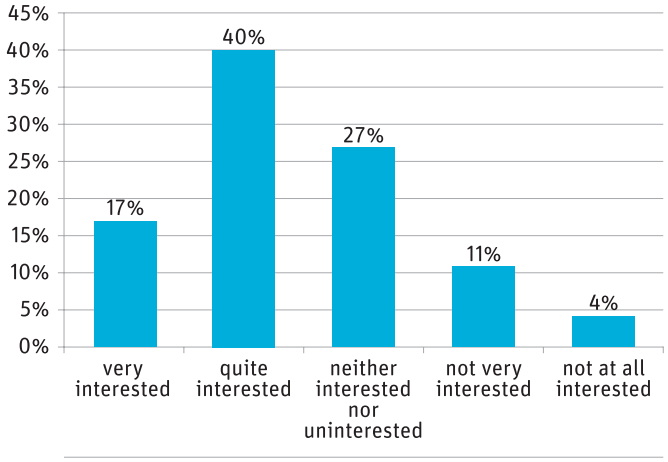
But a study conducted by the Victorian Department of Business and Innovation, in 2007 and replicated in 2011, found the percentage of the population Interested in science and technology, was much less, at 73% (of 800 Victorians polled by telephone poll). It also found that people *Read about science* more often (37% weekly, 15% monthly and 4% every six months) than they *Attended sports events* (22% weekly, 13% monthly and 11% every six months), but *Attended sports events* more often than they *Visited a museum or science museum* (1% weekly, 6% monthly and 22% every six months) (DBI, 2011).

A third study by the Federal Department of Industry, conducted in 2012, came up with a figure between the ANU and Victorian figures. It found about 80% of respondents (2,000 split across online and random phone polling) believed that *Science was so important to our lives we should all take an interest in it* (with the figures lower for women than men, and slightly lower for people under 30 years of age) (Dept of Industry, 2012).

A fourth study, conducted annually by Swinburne University (of 1,000 people), found that the statement *Science and technology are continuously improving our quality of life*, received a rating of 7.24 out of 10 (Swinburne, 2012).

And a fifth study, conducted by CSIRO in 2013 (of more than 1,200 people surveyed by online poll) found only 57% stated they were either *Very interested* or *Quite interested in science* (however it gave an option of Neither interested nor uninterested, which 27% of respondents agreed with). The study also found that people were more interested in technology than science (almost 60%). And when it asked about people's support for science in a more positive frame – asking if people agreed that science was *Very important to solving many of the problems facing us as a society today*, 83% agreed (CSIRO, 2013).

FIGURE 1: **Level of interest in science generally.**
Q: How interested are you in science generally?



So clearly different polls can give different answers, depending on how the questions are framed (and even what questions surround them), but more important questions are what exactly is it that we are measuring, and what do the results tell us about the complexity of people's attitudes to science and/or technology?

Take, for example, the ANU and CSIRO polls, that revealed that 52% and 38% of respondents respectively felt that *Science and technology make our way of life change too fast to keep up with*. This is important to understand as it is a driver of attitudes, and attitudes should be understood in terms of their drivers. The CSIRO study showed, for instance, that answering *Yes* to the above question was a key indicator of a person being less engaged with science and technology, and more likely to view it with suspicion and concern.

So studies of people's levels of scientific knowledge don't always tell us too much about how well people can engage with scientific concepts in real life, as polling just of people's attitudes to science doesn't tell us too much about Why these attitudes exist.

And the key to WHY appears to be understanding values. Values-based studies show there are strong and existing values that largely impact the way we think about science and technology, and any attempts to educate or inform people about the benefits or risks of any new technology will be accepted or rejected based primarily on people's existing values (Cormick, 2012).

To best understand people's attitudes to science and technology, we need to dig a little deeper than most simple polls do, and discover more about the breadth of people's attitudes (recognising that we are not a uniform public) and look at what drives or influences our attitudes.

Surveys have their faults, of course, but they can still be useful if we accept that they are indicative rather than definitive, and they can be very useful for tracking data over time. For instance we can observe from surveys that support for applications of science and technology can rise and fall in line with global paradigm changes (such as risk aversion following September 11, 2001, or concentration on economic benefits following the global financial crisis).

2

Why understanding values is important

An understanding of the role that values play in attitude formation shows how seemingly contradictory positions are possible within members of the community.

For instance, we see people with strong values on the sanctity of nature demanding we respect the science on climate change, but reject the science on genetically-modified crops. And people with strongly pro-development values demanding we respect the science on GM crops, but reject the science on climate change.

Examining values also provides a better understanding of how different attitudes towards issues such as infant vaccination rejection, alternative medicines or embryonic stem cells are formed. People don't reject the science behind these because they are not scientifically illiterate, nor well-educated. They are often highly both. But they have fundamental values that some science and technology clashes strongly with, such as a distrust of multinationals, or a strong belief in the sanctity of life.

VALUES-BASED ATTITUDINAL STUDIES HAVE SHOWN:

- When information is complex people tend to make emotionally-based judgments, driven by values, rather than by the information presented to them (Binder *et al*, 2010),
- Messages that don't align with people's values tend to be rejected or dismissed (Nyhan & Reifler, 2010),
- Broad attitudes towards science and technology and nature can influence consumer attitudes towards particular applications of science or technology (Costa-Font & Gil, 2012),
- Pro-science and technology values are a strong predictor of support for even contentious science or technology such as GM foods (Mohr *et al*, 2007).

3

Trust

Trust in science remains high in Australia, relative to many countries, however there is a lot of ambiguity as to what 'science' means to different people.

A comprehensive review of the science of trust undertaken by Chryssochoidis *et al* (2009) argued that trust can be determined or influenced by four key (and often interacting) factors:

- our perception of the nature of the information received;
- our perception of the risk managed or communicated;
- our perception of the institution in question, and
- the individual and socio-cultural characteristics of those who exhibit trust.

Other factors that impact trust include social trust of the institution being assessed, volume, content and repetition of messages (Chryssochoidis *et al*, 2009), as well as different media themselves, that have differing levels of trust and influence on us, both directly and indirectly (Nisbet *et al*, 2007). While measuring trust in science can be difficult due to a lot of uncertainty and variety as to what people understand science to actually mean, institutional trust is much easier to measure with more certainty.

In Australia the CSIRO has traditionally been the highest trusted organisation conducting scientific research [Figure 2]. In recent years, however, there has been some evidence of slippage, particularly amongst younger Australians. For instance, while over 70% of people over 35 knew who the CSIRO was, that figured dropped to just over

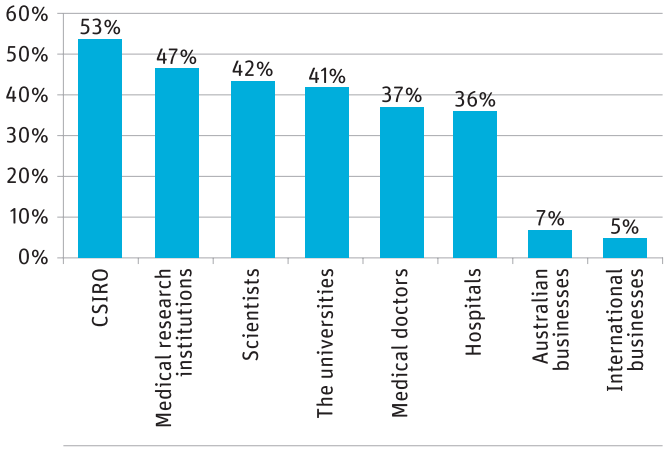
In Australia the CSIRO has traditionally been the highest trusted organisation conducting scientific research...

40% for those aged between 25 and 29, and dropped to about 35% for those aged 18-24 (CSIRO, 2013).

This is significant when coupled with the finding that attitudes towards CSIRO are strongly aligned with 'brand science' and people's attitudes to science are strongly indicative of their attitudes towards CSIRO, and therefore changing trust in CSIRO can be seen as a barometer of changing trust in science.

FIGURE 2: **Trust in organisations conducting research into science and technology, 2013.**

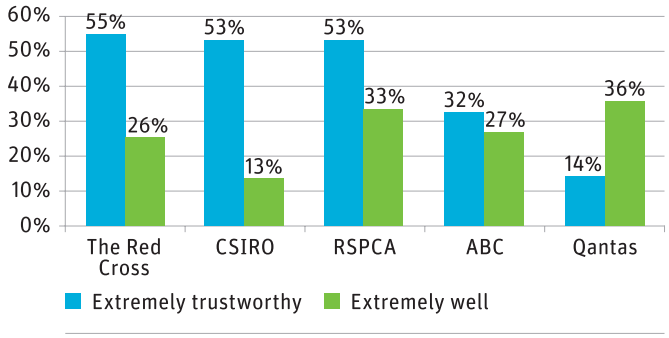
Q: When it comes to research into science and technology, how trustworthy are... n=1,268.



Looking at comparisons of trust with broader Australian institutions, CSIRO has a trust rating of 53%, which compares favourably to the Red Cross 55%, RSPCA 53%, ABC 32% and Qantas 14%. But understanding of what CSIRO does was lower than these organisation at 13% (Qantas 36%, RSPCA 33%, ABC 27% and Red Cross 26%) [Figure 3].

FIGURE 3: **Trust in and understanding of major Australian institutions.**

Q: When it comes to institutions, how trustworthy are... & How well do you feel you could explain to a friend or colleague what the following organisations do... n=1,268



According to the 2011 study by the Victorian Department of Business and Innovation, CSIRO was the second most trusted agency (91% great or moderate trust) compared to *Scientists working for universities or research institutions* (92%), with Hospitals ranking third (90%) (DBI, 2011).

A 2012 study of institutional trust by Swinburne University of Technology, found that CSIRO was the third-highest rated source of trust (3.79 out of 5) following Medical Specialists (4.01) and General Practitioners (3.83). Lower on the list were Universities (3.73) and Hospitals (3.58). (Swinburne, 2012). In 2010, however, CSIRO had ranked at 3.8 above Doctors (3.79) and Universities (3.76) (Swinburne, 2010).

It can be argued that these are minor fluctuations though, and of more importance are dramatic changes in trust, or evidence of longer-term trends of diminishing trust. Towards this, CSIRO has been able to measure the impact of negative media coverage on both trust in CSIRO and support for the organisation, over time.

4

Measuring the impact of negative media coverage on trust

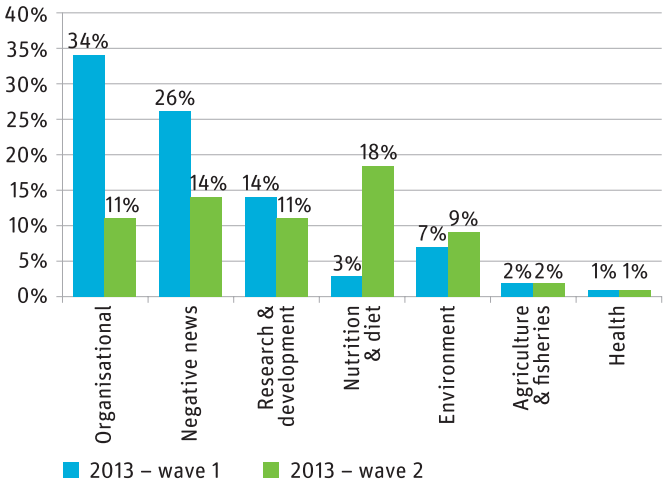
CSIRO's 2013 study was conducted in two waves, with wave one being conducted in April 2013, directly following significant negative media coverage relating to allegations (that were both later shown to be exaggerated or soundless) of bullying with the organisation and also a report about concerns over CSIRO's business dealings with a major pharmaceutical company.

Wave two was undertaken in July, three months later.

The major finding of note was that during wave one of the survey, awareness of criticism of CSIRO in the media was moderate, with 26% recalling negative news, but several weeks later, during wave two, that had effectively halved to 14% [Figure 4].

FIGURE 4: **Topic of recent information about or from CSIRO.**

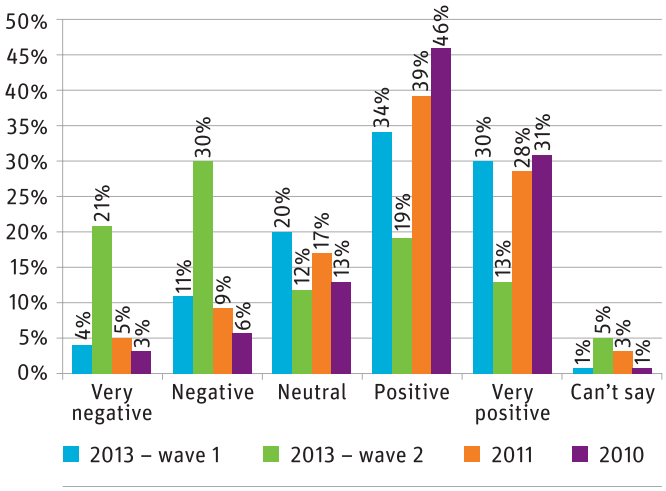
Q: What was it that you saw, heard or read about CSIRO? n=246 – based to only those who had seen, heard or read anything recently about CSIRO.



During wave one, of those who had seen, heard or read something about CSIRO recently, 30% recalled it as being *Negative* and 21% recalled it as being *Very negative*. However by wave two these had dropped to 11% and 4% respectively, showing significant fade in recall [Figure 5].

FIGURE 5: **Impression of CSIRO given by recent exposure to information about or from CSIRO, 2010-2013.**

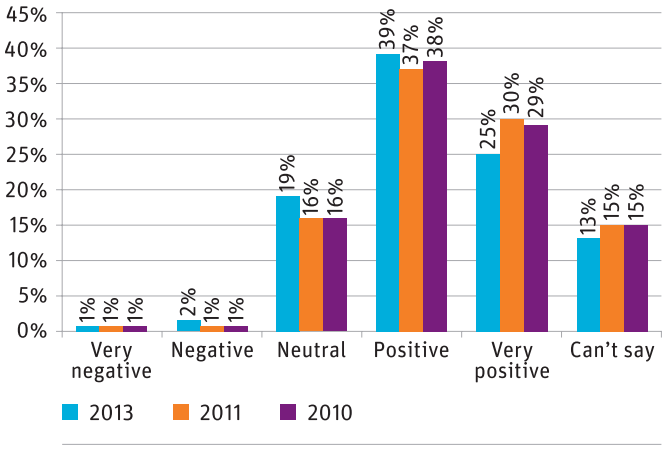
Q: And was what you heard generally positive, neutral or negative about CSIRO? (2010 – n=379, 2011 – n=332, 2013 – n=246) – filtered to only those who had seen, heard or read anything recently about CSIRO.



Looking at what impact the negative coverage had on perceptions of CSIRO over time the results were that the impact was very little. Those with *Very negative* impressions of CSIRO stayed at 1%, those with *Negative* impressions rose from 1% to 2%, and those who were *Neutral* rose from 16% to 19%. The only other change of any significance was those who had a *Very positive* perception of CSIRO dropped from 30% to 25% [Figure 6].

FIGURE 6: **Overall perception of CSIRO, 2010 – 2013.**

Q: Is your overall impression of CSIRO, very positive, positive, neutral, negative or very negative? If you are not sure whether your perception of CSIRO is positive of negative please answer 'Can't say'. n=1,268.



So we could say that the net effect of the negative coverage was that changes of perception towards the CSIRO were short-term and while there was a diminution of those who were *Very positive*, moving towards being *Positive* and *Neutral* – but no real cross over to being more *Negative*.

CSIRO's high and long-standing trust levels undoubtedly played a large part in the rapid recovery of community trust, and while this could reasonably be extended to other organisations with high and long-standing trust, it is not a given that such rapid recovery of trust would continue following long-term or repeated negative coverage.

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5

Sources of information

An understanding of the role that values play in attitude formation shows how seemingly contradictory positions are possible within members of the community.

Understanding where people get information on science and technology helps us to understand what types of information informs, or reinforces, attitudes.

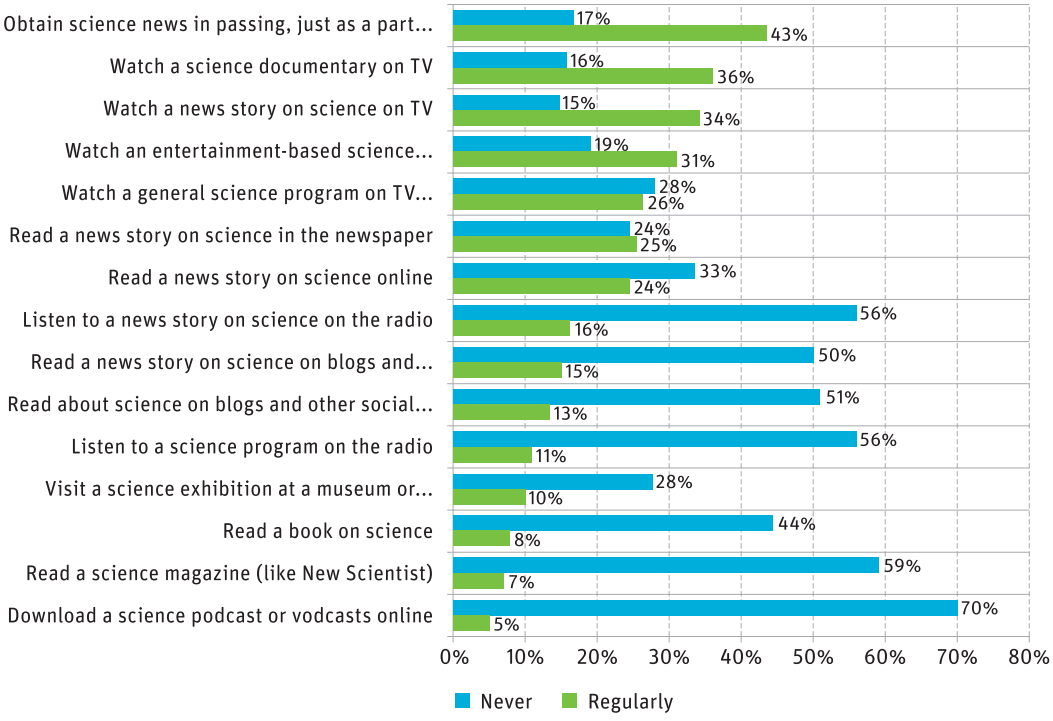
The Victorian Government study, for instance, found that in 2011 Newspapers were the main source of information for passive seekers of information (53%), over Television (50%). It also found the Internet was the main source of information for people actively seeking information on science and technology (79%) (DBI, 2011).

The CSIRO study, by comparison, found that the single largest source of information was from *Obtaining science news just in passing* (43%), or as a part of the

general news (TV 41%, newspapers 30% and online 27%). It also found that only 33% of respondents actively searched for information on science (CSIRO, 2013).

The ANU and Department of Innovation polls did not ask where people got their science news or information from, but the ANU poll did ask how *Well informed* people felt they were, with 55% of respondents saying they were *Well informed* and 44% stating they were *Not being well informed* (ANU, 2010).

FIGURE 7: **Science media consumption.**
Q: How often do you... n=1,268



As to perceived quality differences in the media, the Victorian government study found that the highest-rated sources of information were *Non-commercial media*, including the Australian Broadcasting Corporation (82% trust). *Commercial media* rated only 47% trust, lower than both *Federal and State governments* (53% and 55%). *Scientists working for private companies* rated 57% as credible sources of information (DBI, 2011). The study also found that those with highest levels of interest in science and technology tended to have the highest levels of distrust in the *Commercial media* (11%), and the highest levels of trust in the Non-commercial media (42%).

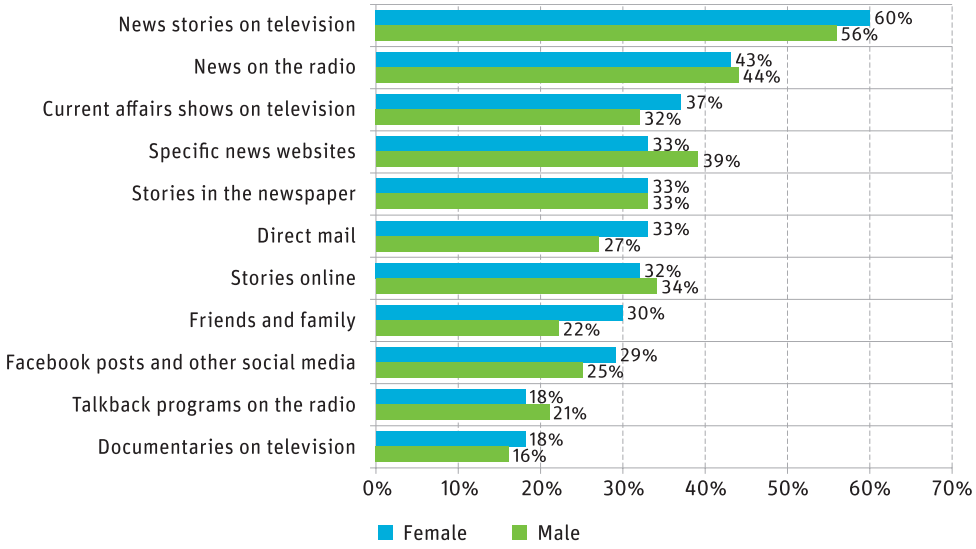
The CSIRO study found that there has been a general drop in science news consumption across all media over the four years that the study was conducted (with previous polls being undertaken in 2010 and 2011). It also found that *Television* remained the preferred medium for obtaining science news (32%) with the next closest being *News websites* (14%). *Online news sites* were found to be more popular for science news than *Newspapers* (9%).

However, 61% of respondents stated they *Did not actively search for information on science*, and the largest single source of information was just In passing, as a part of general news watching (43%). Interestingly, while the largest sources of preferred information on CSIRO was *Television* (74%, and more so amongst the less engaged members of the public) the second-most popular stated source for information on CSIRO was through *Labelling on products developed or invented by CSIRO* (69%).

There were some minor variations in gender preferences for science news, with men more likely to get information

FIGURE 8: **Most relied on source of news and information by gender.**

Q: How often do you get news and information from the following... n=621.[get information 3 or more times a week from channel]

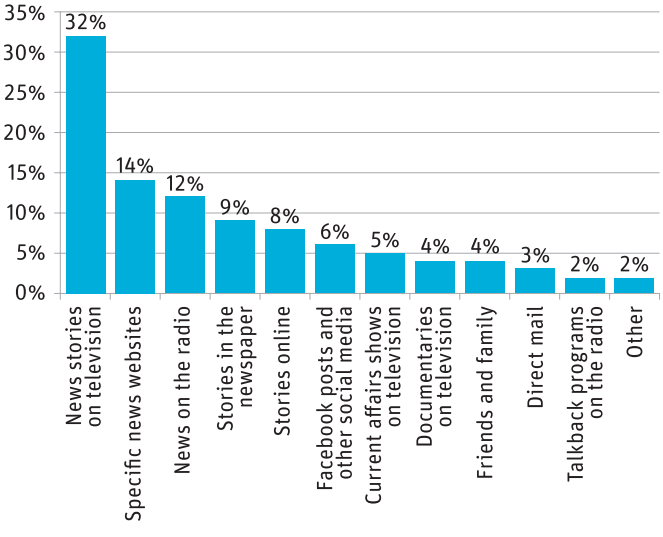


from *Online sites* and women more likely to get information from *Talking with family and friends* [Figure 8] and general news habits, in comparison to science news habits, also favoured *Television* as the most popular source [Figure 9].

It is clear that the media landscape is complex and evolving, and there are indicators that people are increasingly looking for niche media to suit their own attitudes, preferences and ideologies, and as such are no longer exposed to the broad background mass media the way they once were. This has impacts on a diminishing of general awareness of issues by a broad audience, and while it may mean increased ease in reaching those already interested in science, there is general increased difficulty of reaching broader audiences on science and technology issues.

FIGURE 9: **Most relied on source of news and information.**

Q: Which of the following do you rely on most as a source of news and information... n=621.



"It seems that there is a general difference between consumption of 'lean-in' as opposed to 'lean-back' science media: science that reaches audiences through general high audience broadcast channels (for example news programs on TV or the radio) or channels that are otherwise entertaining attract higher regular audiences than those that require audiences to seek out science information – reading a science magazine or book or getting information online."

CSIRO research report, 2013

6

Mistaking media coverage for impact

The correlation between the coverage of a story and its impacts was tested by the CSIRO's analysis of negative media during 2013, already reported on, and also by the Department of Industry in 2009.

The 2009 study looked at the impact of negative news stories about nanotechnology and what impact they had on people's overall perceptions of nanotechnology. The study began by analysing media coverage and identifying topics in the media that were predominantly negative. These were:

- criticisms of the potential dangers of manufactured nanoparticles in sunscreens, and
- concerns that some carbon nanotubes in the workplace could cause similar harm to asbestos (MARS, 2010).

A poll of the Australian public on nanotechnology then asked, firstly, if respondents had seen or heard any media stories on these topics (including other topics as well) and then asked whether the respondents recalled the stories as being *Positive*, *Negative*, *Neither*, or they were *Unsure*.

> **"Nanotechnology can be characterised as a 'white hat' technology, in that most people feel it is intrinsically positive...**

The results were that 36% of respondents could recall news stories about nanoparticles in sunscreens and 15% could recall news articles about carbon nanotubes in the workplace (MARS, 2010). However, only 33% who could recall the story about nanoparticles in sunscreens recalled it as a *Negative story*, compared to 38% who recalled it as a *Positive story* (21% stated neither and 8% were unsure). And of those who recalled stories about carbon nanotubes in the workplace, only 12% recalled the stories as being *Negative*, with 46% recalled them as *Positive* (31% *Neither* and 11% *Unsure*) (MARS, 2010).

So more people actually recalled the negative stories as being positive.

This may be explained in part due to memory fade, but also of the framing of the particular stories based on trust and support. Nanotechnology can be characterised as a 'white hat' technology, in that most people feel it is intrinsically positive, and technologies such as genetically modified foods can be thought of more as 'black hat' technologies, in that many people are intrinsically more negative about them. Supporting this, the same study on nanotechnology found that 46% felt the *Benefits of nanotechnology would outweigh any risks* compared to only 6% who felt the *Risks would outweigh the benefits* (28% felt *Risks equalled benefits* and 21% *Didn't know*, while studies of the risk:benefit ratio of GM foods is usually much closer to balanced) (MARS 2010).

This can be seen as a similar trend to that of trust in CSIRO, in that the impact of any negative media coverage on a science and technology issue has to do with the position of trust, or general positive perceptions, that it starts with.

7

Youth unengagement

Breaking down the CSIRO study into demographic groupings it quickly became apparent that young Australians were less engaged in, or interested in, science than older Australians.

There was also notable fade of both awareness of CSIRO and its impact, from 2010 to 2013, which was most prevalent amongst younger generations.

When asked *What comes to mind when you think of CSIRO?* the average *Nothing* response was 22%, increasing to 25% amongst those aged 30-34, and 37% amongst those aged 25-29 and rising to 41% amongst 18-24-year-olds – double the national average.

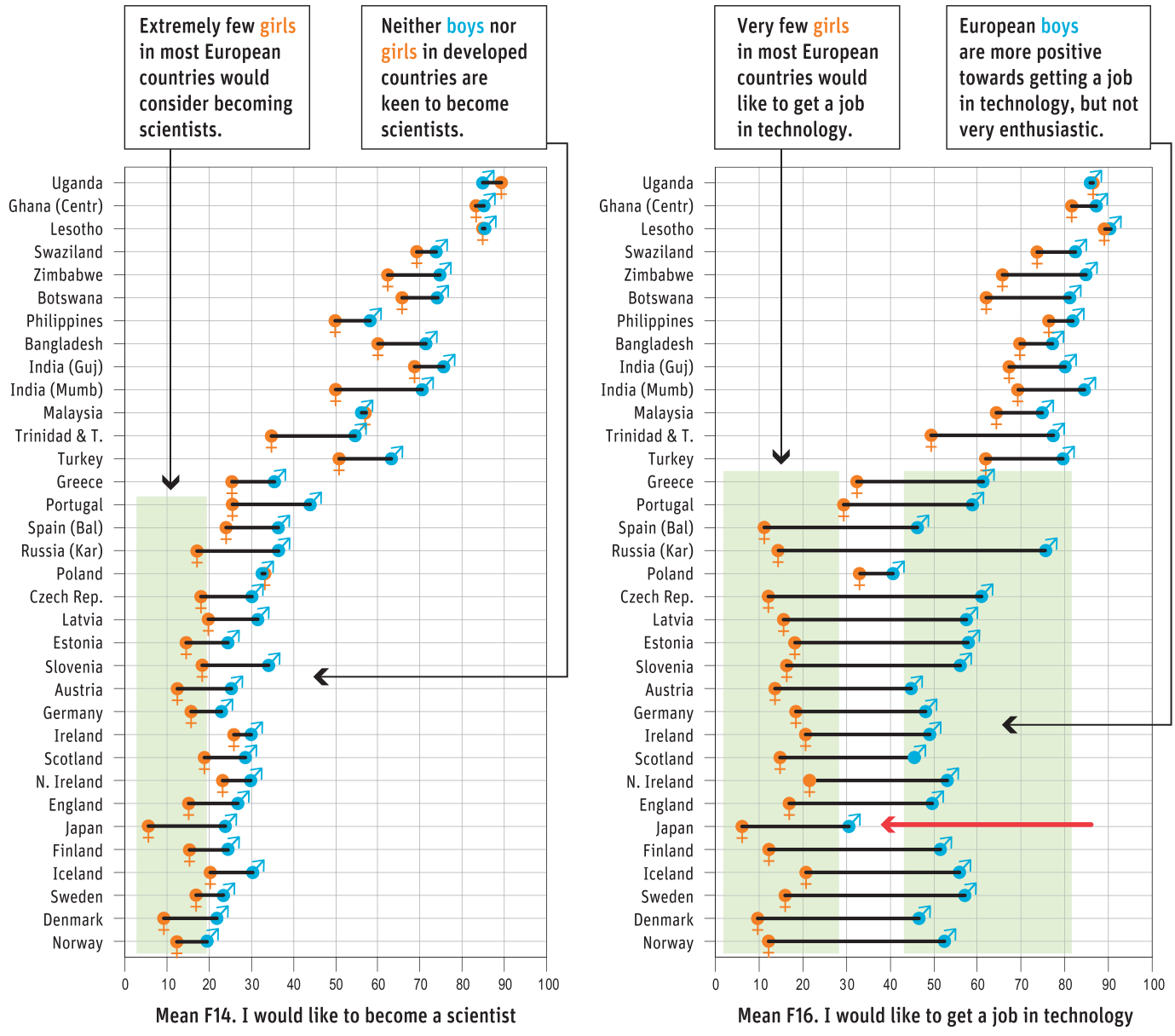
> **...a study of attitudes of young people in over 30 countries found that as a general trend the youth in developed countries were much less interested in getting a job in science than youth in developing countries... *see figure on page 12***

Similarly when asked to identify a *Contribution that CSIRO had made to their lives*, less than 30% of those under 30 years of age could name something, while almost 50% of those aged 55 and over could name something. Tracking the data over time showed that the number of Australians not aware of, and not interested in, CSIRO is slowly increasing, indicating this is not an issue that corrects as people get older and gain more information.

Increasing lack of knowledge or interest in science and science institutions by young people is not a phenomena that is unique to Australia. Looking more widely across Europe, for instance, a 2012 UK Wellcome Trust study found that while 75% of adults say they are *Interested in medical research*, only 58% of young people, aged 14-18, say they are *Interested* (Wellcome Trust, 2012). A UK poll in 2010 found 40% of the 18-24 age group are not registered to vote, compared to 8% of the general population (Ipsos Mori, 2011). And a 2013 US study of more than 3,100 voters under 30, found that faith in most major institutions — with the notable exception of the military — has declined over the past several years. Only 39% of young voters *Trust the president to do the right thing*, as opposed to 44% in 2010 and just 18% of voters under 30 *Trust Congress*, compared with 25% in February 2010 (Harvard, 2013). In addition the Eurobarometer found that while adults in all European countries were more *Positive* towards science and technology (with a few gender differences), young Europeans were more reluctant, particular in the most wealthy countries (Eurobarometer 2008).

Similarly, a study of attitudes of young people in over 30 countries found that as a general trend the youth in developed countries were much less interested in getting a job in science than youth in developing countries, and only boys in developed countries were interested in getting a job in technology – with girls having very little interest. But both boys and girls in developing countries were keen to get a job in technology (Sjøberg, 2008) [Figure 10 *on following page*].

FIGURE 10: **Possible recruitment to science, engineering and technology across developing and developed countries.**



(Sjøberg, 2008)

8

Impact of science at school on attitudes to science

The CSIRO study found that attitudes towards science appear to be conditioned in some members of the community by the way in which they engaged with science at school, as there was a strong correlation with people's experience of science at school and their attitudes towards science (and CSIRO) in later life.

It also found Australians who had a *Positive experience with science at school* or who *Did well in science at school* were more likely to consume all forms of science media than those who did *Not have a positive experience*, nor those who did *Not do well in science at school*.

There was also a correlation between *Not doing well in science at school* and being Less trusting of all institutions who undertook research into science and technology. For instance, only 43% of Australians who had a *Negative experience with science at school* believed that CSIRO was extremely trustworthy while 66% of those who had a very *Positive experience with science at school* believe it to be *Extremely trustworthy*.

One in six Australians (15%) said that their experience with science at school was *Negative*, and a further 26% said it was *Neither positive nor negative*, and together these people tended to be more negatively disposed towards science and the impacts of science. Also of note, while 15% of the general public had a *Negative experience of science at school* – for those aged between 18 and 24, it was reported to be much higher, at 22% (CSIRO, 2013).

Re-engaging with younger people, as well as others who are disengaged with science and technology, is clearly going to require a greater understanding of what drives disengagement, and what values may be crucial in obtaining re-engagement. Knowing that people are tending to prefer media that supports their values, will at least enable organisation to find other ways to reach people who are drifting outside the information reach of traditional, and even many new, media channels.

> **"Re-engaging with younger people... is clearly going to require a greater understanding of what drives disengagement...**

"While one may have been tempted to assume that those that report a negative experience with science at school might display attitudes that were distrustful of institutions in Australian society in general, the fact that these attitudes apply only to CSIRO and not to other institutions shows a targeted disdain amongst this cohort for science and related organisations but importantly not a generalised distrust."

CSIRO research report, 2013

9

Segmentation study 1: Attitudes

Segmentation studies allow us to break a broad sample into similar sub-groups, which provides greater insights into the breadth of different attitudes that can be masked when single average percentage figures are used.

They also allow us to appreciate that there is not one 'public', and that we should think of different publics by the different features that define them – which can be attitudinal, behavioural or values, for instance.

The CSIRO undertook two segmentation studies of the Australian Public, based on studies done by the Department of Industry and the Victorian Government, to be able to benchmark results with their findings. Individually the two segmentation studies provided great insights into the different clusters of attitudes and values across Australian society, but when combined they enabled a mapping of the relationship between values and attitudes towards science.

The first segmentation study defined six key segments by attitude to science and behaviour in seeking out information and understanding it, and were defined by the three questions:

1. How interested are you in science/technology generally?
2. Do you actively search for information on science/technology?
3. When you have looked for information about science/technology in the past, have you generally been able to find what you are looking for?

THE SIX SEGMENTS

Segment 1. 23% 'Mr and Mrs Average'. Passive interest in science.

Segment 2. 23% 'Fan boys and fan girls'. Actively interested in science.

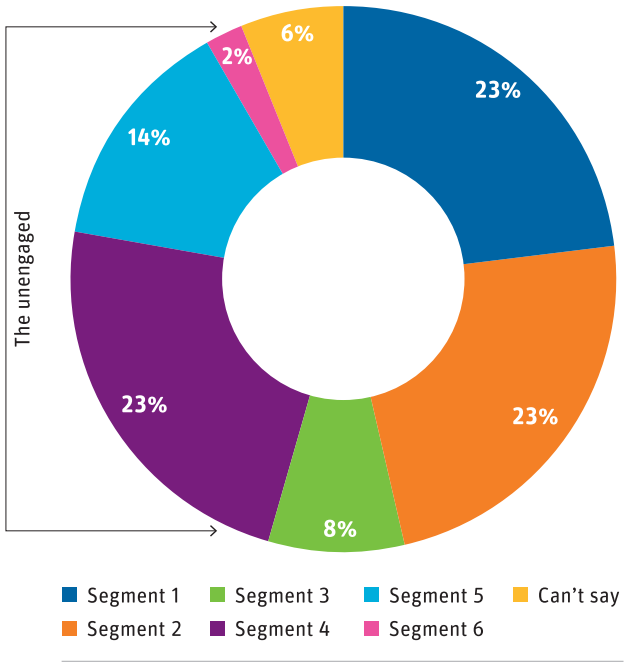
Segment 3. 8% 'Wish I could understand this'. Interested but confused by science information.

Segment 4. 23% 'Too many other issues of concern'. Not really interested in science.

Segment 5. 14% 'Science is a turn-off'. Not interested in science and don't much trust it.

Segment 6. 2% 'I know all I need to know already.' Not interested in science and feel they know enough already.

FIGURE 11: **Six segments by interest and information seeking on science/technology.**



Similar studies that segment the public by their attitudes to science and or technology have been conducted in the UK (Ipsos-Mori, 2012) and in New Zealand (MoRST, 2002) and also show that different segments have notably different attitudes of trust to, and understanding of, science.

Segments 1 and 2, termed 'Mr and Mrs Average'and 'Fan boys and fan girls', who we might also refer to as 'the generally active and generally interested' and 'the active and interested' – make up the bulk of those who watch science programs, read science blogs, take part in science public events and so on (and together make up about 50% of the population). They are the people most easily reached with science communication activities and who by far the bulk of activities are designed for.

The middle 10% or so, are from the segment that looks for information on science and technology but, when they find it, don't understand it well. This segment is very highly represented at science public events (DBI, 2011) indicating a desire to have science better explained to them.

But the last three segments, who together make up about 40% of the public, comprise people who are either unengaged or uninterested in science and they don't much value it, understand it, nor see the point in it. It is no understatement to say that not only is science largely unknown to them, but they are largely unknown to much of science.

The people from these last three segments tend to be more likely younger, more likely female, less well educated, more likely to think *Government funding for science should be cut*, and that *Science is out of control*. The 2011 Victorian study found the three main reasons for having a lack of interest in science among the unengaged segments of the population were that respondents:

- had never been interested in it (25%)
- found it hard to understand (16%)
- had other priorities in life (14%) (DBI, 2011).

10

Quantitative findings

Surveys are very helpful for providing broad statistical findings, but qualitative research through focus groups or other forums are useful for digging deeper into issues raised in surveys.

Focus group studies into the unengaged conducted by the Department of Industry between 2009-12 and by the CSIRO in 2013 (using targeted recruitment and paying incentives to participate), found there were some interesting and unexpected common themes that emerged among scientifically-unengaged members of our community:

- people did not always want to know how a technology worked – they just wanted to know that it did work, that it was safe, and that it would solve the problem that it was intended for.
- nearly all reported a negative experience of science at school (although it's not clear if it was the experience that drove the negative attitude or an existing negative attitudes to science that drove the negative experience).

Focus groups studies conducted by CSIRO in 2013 into those members of the public who were generally unengaged on science showed that there was a sub-set who could be classed as 'rejecters', who unapologetically and proudly chose to wilfully ignore and disbelieve advice that science gave them. Ignorance of many science-related issues was common, and they also had a strong trend in taking a counter position to scientific consensus on issues such as climate change, vaccinations and fluoridation.

Another key finding was that for these segments of the population who were unengaged in science, technology was more important and interesting to their lives than science. For instance, of those who were under 35 years of

age, 54% said they were *Interested in science* and 68% said they were *Interested in technology*. And while 22% of those under 35 said they were *Not interested in science*, only 6% said they were *Not interested in technology* (CSIRO, 2013).

The focus groups also found that amongst these people, how science and technology was framed was important. When the idea of science or technology was explored first in a conversation, people had trouble articulating how it might impact upon them. But when an application of science or technology was explored first they were much more able to articulate how it might impact upon them.

And, when asked who they most trusted to tell them about a science or technology, the focus group members in the Department of Industry studies cited *Friends*, *Relatives* and even *Talkback radio hosts*, often without reference to any expertise.

In short, the unengaged and disengaged segments of the community appear to have quite different values, interests and levels of awareness of science and technology issues, compared to those people who take an interest in science and who science organisations regularly engage with, and require different communication strategies to reach them than those used to reach more engaged or interested members of the community.

11

Segmentation study 2: Values

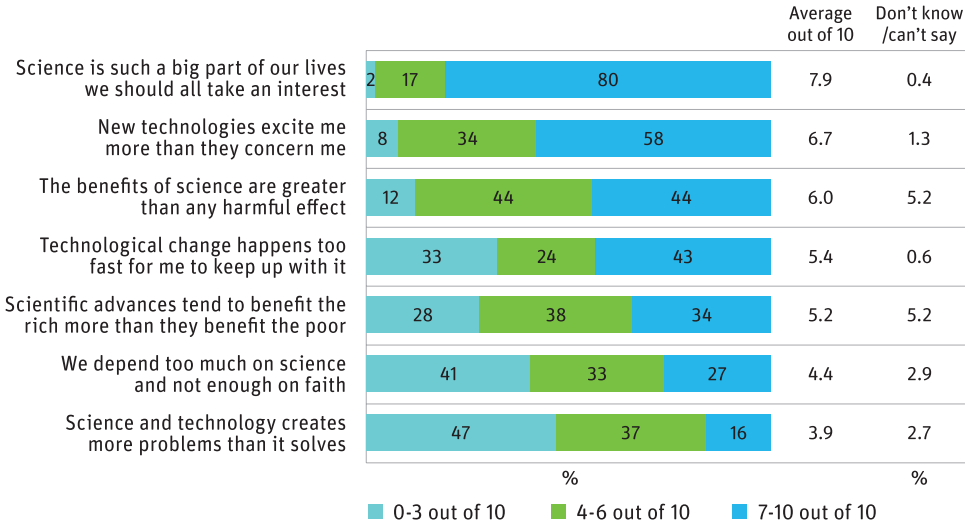
The second segmentation study undertaken by the CSIRO looked at values towards science and the world around us, and found four different segments, replicating the methodology developed by the Department of innovation in 2012, in which 14 values statements were put to the survey respondents [Figures 12 and 13].

The order in which the statements were asked was randomised to diminish any order bias, and respondents were asked the degree to which they agreed or disagreed to each statement across a ten-fold Likert scale. These have been broad-banded into equal thirds for ease of reading the data.

The findings were instructional in revealing the spread of different responses across the different values statements, showing for instance that only 8% of respondents to the Department of Industry survey disagreed that *Not vaccinating children put others at risk*. Also, statements such as *Scientific advances tend to the benefit the rich more than they benefit the poor*, and *People have the right to modify the natural environment to their needs*, received an almost equal balance of those for, in the middle, or against, showing the spread of community responses to these statements.

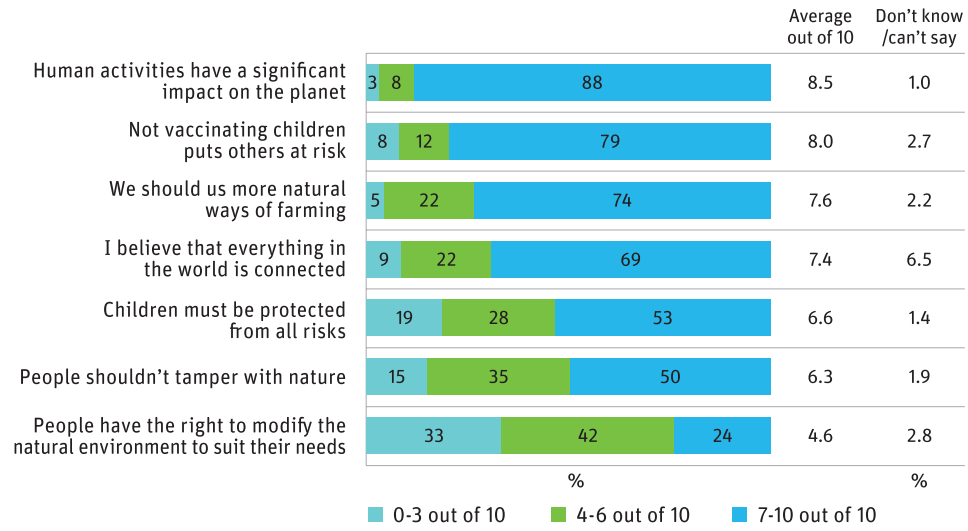
> **...there was a sub-set who could be classed as 'rejecters', who unapologetically and proudly chose to wilfully ignore and disbelieve advice that science gave them.**

FIGURE 12: **The spread of responses to the values statements on science and technology.**



Q1c1-7 On a scale of 0-10, would you say do you disagree or agree that
Filter: 2012 only AND CATI only: Weighted to population;
Base n = from 948 to 996; Total n = 1000

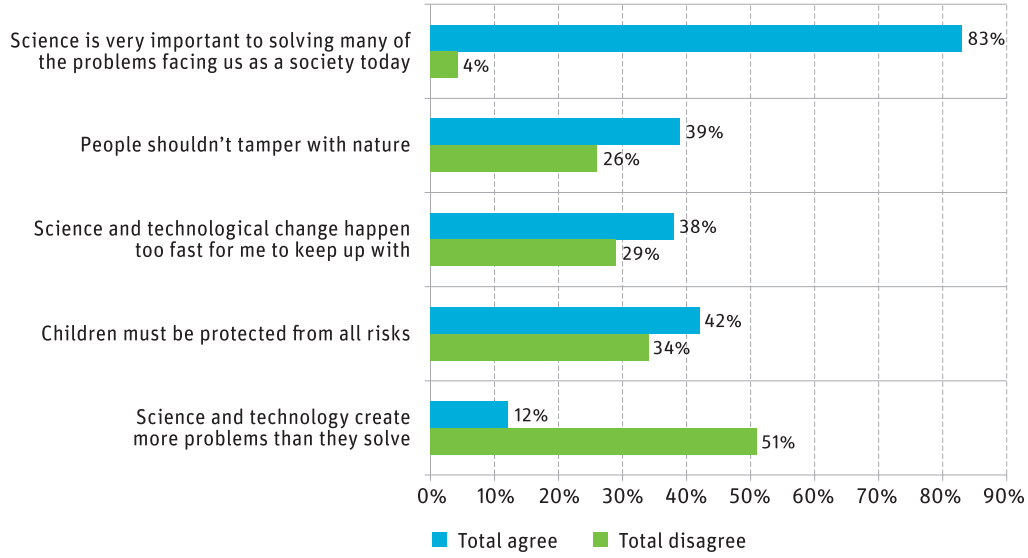
FIGURE 13: **The spread of responses to the values statements on the world around us.**



Q1c8-14 On a scale of 0-10, do you disagree or agree that
Filter: 2012 only AND CATI only: Weighted to population;
Base n = from 935 to 990; Total n = 1000

Analysing the total responses to all the values statements the study found five values were key in defining the four different values-based segments [Figure 14]. The results also showed that two of the segments (Segments 1 and 2) were more positive toward science and technology, and two segments (3 and 4) were less positive. (See box below.)

FIGURE 14: **The key values statements that defined the values-based segments and general responses to them.**



THE FOUR KEY SEGMENTS WERE:

Segment A (23%) – the science fans:

This group was the most positive towards science and technology. They expressed greater agreement that *Science is such a big part of our lives that we should all take an interest*, that *New technologies excite me more than they concern me* and that *The benefits of science are greater than any harmful effects*. Equally, there was disagreement that *Science and technology creates more problems than it solves* and that *We depend too much on science and not enough on faith*.

Segment B (28%) – the cautiously keen:

Segment B was defined by relatively high interest in science and agreement that *The benefits of science are greater than any harmful effects*. However, they also had the highest agreement that *Children should be protected from all risks*.

Segment C (23%) – the risk averse:

This segment tended to be less positive towards the benefits of science and technology. They were also more concerned with risks. But in contrast to Segment D, they had relatively high awareness of science. They were least likely to agree that *Human activities have a significant impact on the planet* and least likely to agree that *Not vaccinating children puts others at risk*.

Segment D (20%) – the concerned and disengaged:

Segment D was the least enthusiastic about the benefits of science and technology. They had the highest agreement that *The pace of technological change is too fast to keep up with* and were the most likely to agree that *Science and technology creates more problems than it solves*, that *Scientific advances tend to benefit the rich more than the poor*, and that *We rely too much on science and not enough on faith*.

> **Indeed, on most of the values statements, Segment A (the Science Fans) could be described as outliers, with responses that were more significantly different to the average community responses than any other segment.**

FIGURE 15: **How the different values-based segments map against interest in science and technology.**

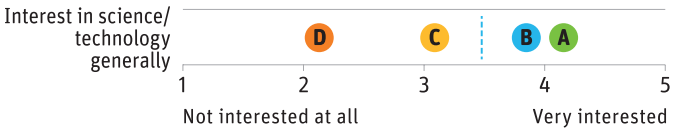
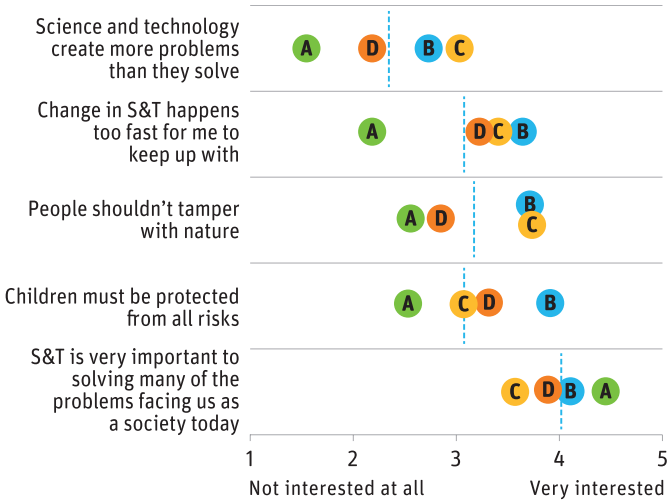


FIGURE 16: **How the different values-based segments map against different values statements.**



Of interest, when the segments are mapped against value statements there is not a uniform spread of A – B – C – D, and they move positions considerably against different statements. For example, against the statement, *Children must be protected from all risks*, Segment B was the most agreeing and Segment A was the most disagreeing, but against the statement *Science/Technology is very important to solving many of the problems facing us as a society today*, Segments A and B were much more closely aligned. And Segment D, who had the least interest in science and technology, was not rated as the most for or against any of the statements. Also of interest was the large extent to which Segment A disagreed with the statement, *Change in science/technology happens too fast for me to keep up with*, compared to the other three segments. Indeed, on most of the values statements, Segment A (the Science Fans) could be described as outliers, with responses that were more significantly different to the average community responses than any other segment.

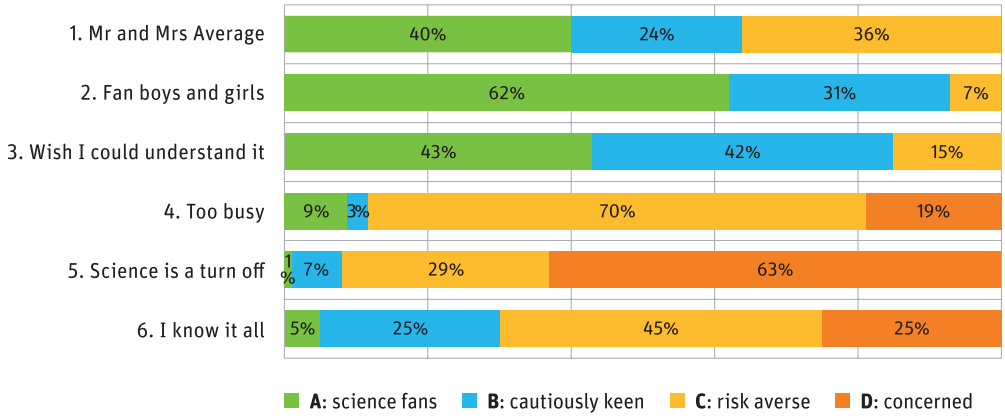
This is particularly of interest in understanding how Science Fans so often misread the mood of the general public on issues relating to contentious science and technologies.

COMBINING THE SEGMENTS

By combining the two different segmentation studies, and layering values across attitudes, it is possible to see that certain values are specific to different segment groups [Figure 17].

In particular, Segment 2 had a predominance of Science Fan values (60%), Segment 4 had a very large

FIGURE 17: **Combining the two segmentation studies allows for an understanding of how values align with, or drive, attitudes towards science.**



> **...we can even analyse preferred media types of different segments, to not only understand where different people get their information from, but also how best to reach them.**

predominance of Risk aversions values (70%), and Segment 5 had a predominance of Concerned values (63%). Also, and significantly, Segments 4, 5 and 6, the most unengaged, had the least members whose values reflected those who were Science Fans or Cautiously Keen, and segments 1, 2 and 3, who were the most engaged, had no members at all whose values represented the Concerned. Taken together this provides a mapping of 20 or so key sub-segments of the Australian population

And that provides significant insight into the values of those who are generally unengaged in science and technology, and what may be driving their attitudes. There is also growing recognition, from public debates on contentious technologies, such as genetically modified foods and nanotechnologies, that values play an important part in attitude formation, with five general findings:

1. When information is complex, people make decisions based on their values and beliefs.
2. People seek affirmation of their attitudes (or beliefs) – no matter how fringe – and will reject any information or evidence that are counter to their attitudes (or beliefs).
3. Attitudes that were not formed by logic (nor facts) are not influenced by logical (nor factual) arguments.
4. Public concerns about contentious science or technologies are almost never about the science – and scientific information therefore does little to influence those concerns.
5. People most trust those whose values mirror their own (Cormick, 2012).

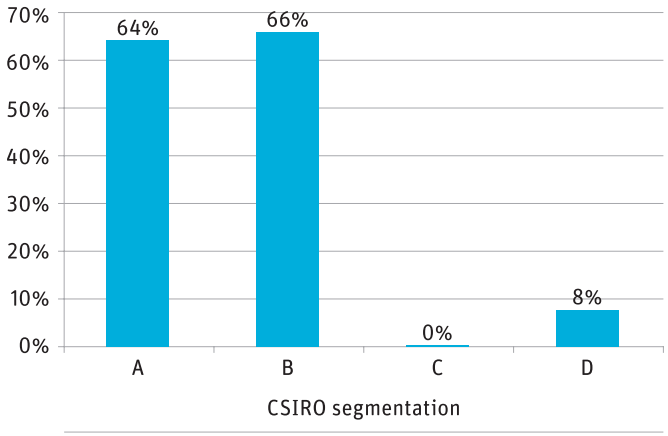
Accordingly, increased knowledge of what values different segments of the population hold can be useful for understanding how different attitudes are formed, but they are also useful for guiding the framing of messages to better align with the different values of different groups. And added to this we can even analyse preferred media types of different segments, to not only understand where different people get their information from, but also how best to reach them.

For instance, young unengaged people whose values may be predominately around concerns over the pace of scientific change, yet who find technology 'cool', are actually not best reached through social media, as might easily be presumed. Rather they are best reached by mainstream television and current affairs programs, using messages of the personal benefits of technology, and also making the future less worrisome.

When asked if they would actively look for information on science, 64% of segment A (the Science Fans) responded *Yes*, 66% of Segment B (the Cautiously Keen) responded *Yes*, but 0% of segment C (the Risk Averse), and only 8% of segment D (the Concerned) responded *Yes*, showing just how polarised the differences in behaviours are between the interested in science and those not interested in it [Figure 18].

FIGURE 18: **Active seekers of information on science by Values Segments.**

Q: Do you actively seek information on science?



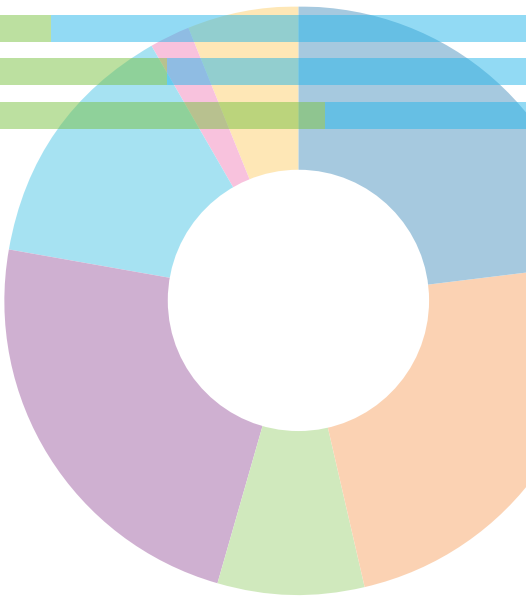
12

Conclusion

Trying to provide a simple averaged answer to the question of what Australians think about science and/or technology can be misleading, as there are quite widespread differences in attitudes across society.

Deeper analysis of these differences, however, provides not only a broader understanding of the diversity of attitudes, but what drives them. And these findings in turn can be used to provide insights into how communication and education of science and technology can be improved, by understanding the values that drive different people's opinions, and then seeking to align communication efforts with those values.

> **...these findings in turn can be used to provide insights into how communication and education of science and technology can be improved...**



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CONTACT US
t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
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