

Happily ever after... A systematic literature review of the use of storytelling in extending agricultural research

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Abstract. Institutions conducting research and development for the agricultural industries want to maximise the extension and adoption of their findings among the farming communities they serve. Extension methodologies and efforts vary around the world. This article focuses on the Australian perspective and draws on a detailed global context to better understand how research might inform the use of creative non-fiction storytelling to aid new technology adoption. It explores how the literature can provide evidence for constructing a theoretical creative non-fiction storytelling extension framework. The results are considered to find better ways to apply international research to Australia's challenges of improving research and development uptake. The article considers whether the Australian context has extended value in global agricultural innovation and adoption.

Keywords: storytelling, creative non-fiction, agriculture research, extension.

Introduction

In Australia, the flagship agricultural agencies are the 15 Australian Rural Research and Development Corporations (RDCs) (Australian Government Department of Agriculture 2019). Producer levies, collected on agricultural commodities sold, are invested into the corporations and matched by Federal Government taxes to support long-term R&D for each sector. In 2018 they invested \$600M in research and development (R&D) activities (Council of Rural Research and Development Corporations 2018). This is approximately one-third of all agricultural R&D investment in Australia (Council of Rural Research and Development Corporations Impact Assessment Guidelines 2018), when considering activities by private enterprise and other government agencies. There is an industry and government mandate that the RDCs demonstrate value to their investors - the government and the levy-paying farmers - and the performance of the RDCs is routinely assessed by the Australian Government (Council of Rural Research and Development Corporations 2017-18). Therefore, there is a strong desire by all organisations undertaking R&D to demonstrate end-user impact – i.e. adoption of new technologies and best practice principles by those in the agricultural supply chain.

The RDCs are under pressure to increase the impact of R&D and demonstrate better value from research investment. Sewell et al. (2013) state that farmers have been historically slow to adopt new and evidence-based farming systems. A 2014 Meat & Livestock Australia (the RDC for red meat industries cattle, sheep and goats) report found just three per cent of Australian cattle graziers were actively interested in changing, while 43% had low interest in changing any form of practice (Donnelly et al. 2014). The same report cited literature from Germany where technology adoption rates were lower than 10% among German farmers, despite the ability of these technologies to support farmers' needs. These figures are despite the evident ongoing changes in some farming sectors, such as the widespread adoption of genetically modified cotton varieties or zero/minimum-tillage in broadacre cropping. While it is recognised that there are many farmers that have adopted technology, based on current data, there is still a great potential for Australian agriculture to increase its gross value. Heath (2018) and GHD & AgThentic (2018) report that 'implementation of digital agriculture alone could lift the gross value of the Australian agricultural industry by \$20.3 billion, a 25% increase on 2014/15 levels' (p. 10).

Therefore, the precise issue challenging the RDCs is the speed at which adoption of emerging technologies is occurring, in order to maximise farm profitability and productivity. There are many legitimate and varied reasons farmers may have for not integrating new ideas into their business. A 2018 report commissioned by AgriFutures, the RDC responsible for emerging commodities and ag-technology states (GHD & Agthentic 2018, p. 27):

Adoption of emerging technologies by farmers is constrained by their ability to readily use the technology, or easily adapt their systems to accommodate the technology. When the adoption process is complex, lengthy, or expensive, farmers are not likely to participate.

This statement both accepts the reality of the barriers to adoption as well as challenges the adoption process. The slower than desired rate of adoption of new practices, and the unwillingness of a significant number of producers in some sector to change practices (Donnelly et al. 2014), occurs despite significant investment, both financial and intellectual, in a range of communication and extension strategies by the RDCs, State and Federal governments and the private sector. The Grains Research and Development Corporation (GRDC) alone spends \$9M a year on programs to

support adoption of R&D (GRDC 2017). Communications teams sit within all RDCs, which also externally contract private agencies to deliver fit-for-purpose projects designed to deliver research advice to primary producers. In-house teams typically feature a program manager and support staff with skills in website and social media content management, copyrighting and event management. External consultancies are engaged on a needs basis for specialist skills in areas such as media management, photography and video production, branding and graphic design, and content development for special publications (Thomson & Rowe 2019).

Communications strategies (Doroschuk & Staroverova 2017) are devised by these communications teams and their support agencies and detail each campaign's objective (i.e. what behaviour is the campaign seeking to change); the target audiences; the key messages to be used to persuade the audience to adopt new practices; and the tools and channels to be used in delivering those messages to the audiences (Mei et al. 2003). While each of these campaigns is unique in its content, creative design and strategic approach to communicating research messages to the target audiences, the campaigns typically focus on delivering factual information through efficient and wide-reaching channels (Thomson & Rowe 2019) - e.g. media releases to the press, photos and captions via social media, detailed reference material via websites, fact sheets distributed at field days (MLA 2016). These materials are bound in a thematic narrative through repetitive use of the key messages, imagery, and brand iconography. These align with the stage of increasing audience knowledge in Rogers' (2003) five-stage process of decision innovation of knowledge/awareness raising, persuasion, decision making, implementation and confirmation/continuation.

As part of these knowledge or awareness-raising activities, the RDCs and corporate communicators regularly use information-based narratives such as 'case studies' or 'testimonials' as a form of storytelling within these campaigns. Lugmayr et al. (2017, p. 15710) defines these types of stories as 'serious storytelling' which 'falls outside the context of entertainment [and] where the narration progresses as a sequence of patterns impressive in quality, relates to a serious context, and is a matter of thoughtful process'. Corporate communicators use this form of storytelling to stimulate interpersonal 'over the fence' storytelling or 'word of mouth marketing' (Augusto de Matos & Vargas Rossi 2008). These have proved to be persuasive by encouraging discussion among farmer groups resulting in practice change (Petit et al. 2011; Sewell et al. 2013), as they stimulate farmers to seek further and more detailed information from website repositories or farm advisors. They are 'information-based stories' designed to fit within a narrative of fact-based advice.

This approach of using 'information-based stories', structured in the form of 'problem and solution', is distinctly different to the genre of creative non-fiction storytelling (Avieson 2014). Creative non-fiction storytelling combines literary storytelling devices, usually associated with fictional storytelling, to convey factual situations (Avieson 2014). As outlined below, this genre is more closely aligned to the stage of persuasion in Rogers' (2003) process.

The Australian identity has a strong tradition of storytelling - the campfire yarn, swapping tales over the fence, sharing a cuppa. As such, storytelling forms an important part of the cultural identity of rural Australia (Frost 2004). In fact, in the tradition of Banjo Patterson and Henry Lawson, bush poets are still employed as entertainment at gatherings in agricultural communities (*Bundaberg News Mail* 2010). But until recently literary forms of non-fiction storytelling were not given credibility as 'reliable and valuable records of experience' (Perl et al. 2007, p. 306) due to its subjective representation of reality in order to convey truth. However, creative non-fiction storytelling has enjoyed an academic renaissance moving towards acceptance of 'storytelling as a compelling and valid way to reveal the data they have gathered' (Perl et al 2007, p. 306), and is appealing because 'stories attract and hold readers, drawing them ever more deeply into a conversation they might otherwise miss or abandon' (p. 307). This has happened concurrently with some academic and research sectors embracing story-telling methodologies as a means of knowledge translation and extension (Delgado-Ballester & Fernandez-Sabiote 2015; Lacoste & La Rocca 2016).

Research undertaken by some rural R&D agencies has in fact called for the embrace of storytelling in their methodologies, although it is not clear whether this includes the creative non-fiction genre. In investigating ways to improve farmer engagement, participation and adoption of research, Turner et al. (2014, p. 4) recommended to MLA that it 'tell the stories of best practice managers through less formal, non-MLA avenues (including multi-media links) to increase the number of available neighbouring fences to "look over"'.

This paper uses a systematic literature review to determine the level of uptake of creative non-fiction storytelling as part of current agricultural extension programs and its potential effectiveness as a different method of engaging farmers with R&D to encourage adoption.

Creative non-fiction storytelling

Creative non-fiction stories feature complication, crisis and solution; they feature character development as a result of the causality of events (i.e. the events portrayed have consequences for the characters and affect their subsequent actions) (Delgado-Ballester & Fernandez-Saboite 2015); they stimulate an emotional connection between the storyteller and reader/viewer/listener (Widrich 2012); and they expand our understanding of ourselves, our culture and our place by helping the reader identify with characters from different circumstances thus 'disrupting readers' tendency to stereotype and judge' (Sleek 2014). As a result, absorption and recollection of the material is high (Grace & Kaufman 2013).

Creative non-fiction has become a popular form of writing because of its power in combining literary storytelling devices to convey factual situations (Perl & Schwartz 2014). It is different from historical, biographical or scholarly writing, in that it is not focused solely on fact, but on creating a sense of the 'emotional truth' of the situations the characters face. De Souza & Morton (2002) define emotional truth as the accuracy of the emotions portrayed by characters in interpreting the world around them. The role of emotional truth is important to persuasion given the role emotions play in influencing 'neural information processing related to motivated reasoning' (Weston et al. 2006, p. 1955), which functions differently from neural processing for decisions made in the absence of emotion.

The strength of creative non-fiction story telling lies in its ability to both utilise and overcome the philosophical problem of the paradox of fiction, which states that people have real emotional responses to fictional characters and situations, but in order to be emotionally involved they must on some level believe that these fictional characters or events truly exist while simultaneously knowing that they are not real. This paradox is the foundation for Samuel Taylor Coleridge's theory, first laid out in his *Biographia Literaria* (1834), of willing 'suspension of disbelief', which is defined by the Oxford English Dictionary (2018) as the 'willingness to suspend one's critical faculties and believe something surreal; sacrifice of realism and logic for the sake of enjoyment'. Creative non-fiction generates the emotional response to the characters and events using fictional storytelling techniques, but does not require a suspension of disbelief because in both fact and emotion, the situation is real.

The role of literary devices in revealing truths beyond the factual or historical is not new. English novelist E.M. Forster, in his 1927 lecture series on *Aspects of the novel*, says that history alone cannot adequately capture the nature of existence.

The historian deals with actions, and with the characters of men only so far as he can deduce them from their actions. He is quite as much concerned with character as the novelist, but he can only know of its existence when it shows on the surface (p. 55).

In contrast, he says 'it is the function of the novelist to reveal the hidden life at its source' (pp. 55-56) and later adds that 'in this direction fiction is truer than history, because it goes beyond the evidence' (p. 69).

While Forster discussed the role of history and fiction as separate genres each revealing aspects of truth, in their 2014 definitive guide to writing creative non-fiction, *Writing true*, Perl & Schwartz (2014, p. 3) posit that:

"creative" plus "nonfiction" produce a synergy that attracts fiction and nonfiction writers alike... novelists, journalists, editors, poets, and educators, [are] all drawn to the power of these paired words that invite the poet's attention to language, the fiction writer's power of storytelling, the journalist's pursuit of fact, and the scholar's reliance on research.

While the term 'creative non-fiction' is a modern term, that is not to say the genre, or its use in persuasive argument, is new. An early example of creative non-fiction for the purposes of persuasion is Virginia Woolf's (1928) *A room of one's own*, delivered originally as a lecture series advocating the need for support for women's creative arts. The written work exemplifies the genre of creative non-fiction as a vehicle for delivering a detailed intellectual argument through descriptive storytelling. Woolf makes her case both from a personal perspective, citing her own experiences, as well as a scholarly perspective, providing detailed and revealing historical context to demonstrate her exposition of gender discrimination in the literary world. She justifies her approach at the outset stating that she would aim to show, rather than prove, how she came to her opinion (Woolf 1928, p. 6):

One can only give one's audience the chance of drawing their own conclusions as they observe the limitations, the prejudices, the idiosyncrasies of the speaker. Fiction here is likely to contain more truth than fact.

In this sentence alone she makes the case both for the genre of creative non-fiction, as well as the power of fictional storytelling to reveal to the audience truths unobtainable by fact alone. Today, this genre has been classified as 'creative non-fiction'.

Accepting the premise that storytelling (Greenhalgh 2001; Petit et al. 2011; Easton 2016) and creative non-fiction storytelling (Hunter & Hunter 2006; Perl et al. 2007) are academically valid and effective methods of communicating scientific research, the question is whether it has or has not been embraced and tested by the agricultural extension sector relative to its adoption in other sectors. This paper uses a systematic review process (Gough et al. 2017) to explore the literature to determine: what evidence is there to assess whether creative non-fiction storytelling - as opposed to information-based narrative case studies - is superior in stimulating curiosity and willingness to change among farmers? And whether there is evidence that creative non-fiction storytelling can be used as a persuasive tool within the suite of agricultural R&D extension methods to support faster adoption of new practices and technologies.

Methods

A systematic literature review uses a series of structured search terms and defined databases to establish previous research (Gough et al. 2017). This approach has been chosen as it provides a robust repeatable method to search several literature sources. According to Pullin & Stewart (2006), an evidence-based framework, such as a systematic literature review, provides 'a more efficient and less biased platform for decision making' (p. 1647). Margalot & Chung (2007, p. 1834) argue that traditional expert reviews 'often suffer from inherent personal biases and may not reflect a true synthesis of the existing literature on a particular subject'. This is overcome by systematic reviews because they are structured, scientific articles based on reproducible methods. The results are presented using both quantitative and qualitative methodologies. The foundation for the literature review is the search terms.

Search terms and targets

An initial examination of the literature revealed the importance of having a clear definition for 'storytelling' and identifying appropriate search terms. It has been acknowledged that creative non-fiction techniques are not new but the classification of these stylistic characteristics as a genre is relatively recent. This limits the ability to search for research which may have been conducted examining the method prior to its definition as a unique genre. Therefore, for the purposes of this paper, a series of ever-widening searches were conducted during 2018 to elicit evidence of the use of and analysis of creative non-fiction storytelling in agriculture. The initial search was limited to academic literature via Scopus, and due to a lack of results widened to a grey and commercial literature search via Google. In conducting the searches, the following steps were followed:

1. Three search terms were selected to identify the widest possible selection of journal articles pertaining to the question of the whether storytelling is an effective form of extension. 'High level' search terms were necessary in order not to inadvertently exclude relevant information.
2. Definition of search terms:
 - 'storytelling' – narratives featuring literary devices such as complication, character development, description, crisis and solution, which stimulate an emotional connection between the storyteller and reader/viewer/listener to expand understanding of self, culture or place.
 - 'creative non-fiction' – the use of literary storytelling devices more commonly associated with fiction to convey factual situations; different from historical, biographical or scholarly writing in that it is focused on fact as well as creating a sense of the emotional truth of the situations the characters face.
 - 'agriculture' – pertaining to primary production. This term was used in conjunction with the searches for 'creative non-fiction' and 'storytelling' to ensure results were relevant to the agricultural extension.
3. Search phases:
 - Scopus
 - Google Scholar
 - Grey literature and industry reports from Australian agricultural research bodies Meat & Livestock Australia, the Grains Research and Development Corporation, the Churchill Trust, and Nuffield Australia
 - Papers identified through Australian agricultural extension and industry networks and recommendations.

4. Appraisal – each abstract or search summary was analysed to determine whether the paper directly evaluated the effectiveness of storytelling and/or creative non-fiction as an agricultural extension tool.
5. Analysis – matching papers were read in full to dissect findings as to the effectiveness of storytelling / creative non-fiction.

Results

Scholarly publications

The results for scholarly publications identified via various search terms and search engines are shown in Table 1. The primary article identified was via Google Scholar: 'Effecting change through storytelling' (Grace & Kaufman 2013), which was drawn from the post-doctoral dissertation 'The effects of storytelling on worldview and attitudes toward sustainable agriculture' by Patricia E. Grace (2011) at Virginia Polytechnic Institute and State University. The study measured the impact of creative non-fiction story-telling versus information-based materials, on the attitudes of two cohorts of university students: agriculture students, who had lived or worked on farms and had an understanding of farming practices, and arts students, who were not from a farming background and did not have a prior affiliation with agricultural practices.

Table 1. Search terms, search engines, and results for scholarly publications.

Search Terms	Search Engine	Results	Assessment
'creative non-fiction' and "agriculture"	Scopus	0 results	
"storytelling" and "agriculture"	Scopus	9 articles	1 article (Petit et al. 2011) assessed the use of storytelling for scientific extension, but only indirectly addressed agriculture. The remainder did not address the question of the effectiveness of storytelling, mentioning storytelling and agriculture as passing terms in discussion of other topics.
"Storytelling" within field of Agricultural and Biological Sciences	Scopus	55 articles	0 articles addressed the question of the effectiveness of storytelling in agricultural extension. 5 articles contained relevant subject matter relating to the effectiveness of storytelling in biological sciences (specifically medical training) but did not assess its use for agricultural extension. The remainder referenced storytelling in passing and did not address the question of its effectiveness in extension.
"storytelling" and "agriculture"	Google Scholar	39,600 results	1 article (Grace & Kaufman 2013) directly matched the intention of the search - i.e. scientific literature detailing the effectiveness of storytelling in delivering attitudinal change in agriculture. A summary search of the remainder of the articles revealed incidental mentions of agriculture and / or storytelling in papers on topics such as mathematics and medicine, or alternatively mentioned that storytelling was used in extension programs, without evaluating its effectiveness.

Therefore, the key finding of the literature review is in fact a dearth of literature addressing the question of whether storytelling is an effective method for communicating research to farmers to drive practice change and adoption of new agricultural technologies.

Industry reports

In light of the lack of academic literature, the search was widened again, using the same search terms, to take in research reports from agricultural R&D organisations, including MLA (www.mla.com.au), GRDC (www.grdc.com.au), Nuffield Australia (nuffield.com.au) and the Churchill Trust (www.churchilltrust.com.au) (Table 2). No research reports were found within these institutions directly addressing the question of the effectiveness of storytelling in agricultural extension. However, as with the Scopus and Google Scholar searches, a limited number of reports were identified which discussed the use of storytelling in other contexts.

Table 2. Search terms, search engines, and results for selected agricultural industry research organisations.

Search Terms	Search Engine	Results	Assessment
"creative non-fiction" and "agriculture"	MLA, GRDC, Nuffield Australia, Churchill Trust	0 results	
"storytelling"	MLA	1 report	The report mentioned storytelling in extension, but did not examine its effectiveness.
"storytelling"	GRDC	1 report	The report recommended storytelling be included in extension programs, but does not provide an objective analysis of the effectiveness of storytelling as an extension tool.
"storytelling"	Nuffield Australia	1 report	The report provides anecdotal evidence of the power of storytelling in wine marketing. It does not provide objective assessment of the effectiveness of storytelling in changing behaviour.
"storytelling" and "agriculture"	Churchill Trust	25 results	1 report (Lush 2017) indirectly addressed the question of the effectiveness of storytelling and its effectiveness as a method of agricultural extension.

This scarcity of results may seem unusual, however, a literature review by Rose et al. (2016) for storytelling research found the bulk of the 115 papers they identified came from the fields of medicine, health, business, humanities and education, with just one paper identified from the communications sector. Agriculture was not listed in their literature review.

Discussion

The articles identified - namely one academic report (Grace & Kaufman 2013) directly addressing the question, plus six academic articles (Greenhalgh 2001; Hunter & Hunter 2006; Petit et al. 2011; Easton 2016, Heilman 2016, and Rose et al. 2016,) and one R&D report (Lush 2017) which indirectly address the question - will form the basis of this discussion. Given the lack of evidence of assessment of creative non-fiction as a persuasive tool directly targeting farmers, the discussion includes examples of its use in the broader agriculture sector. The discussion then turns to other non-agricultural sources which discuss the reasons why creative non-fiction storytelling is an effective extension method.

What the literature says

As the definitive research studies identified, Grace (2011) and Grace and Kaufman's (2013) reports will be considered the primary sources of evidence. In her 2011 thesis abstract, Grace (p. ii) states there is a 'growing body of research in other disciplinary areas suggest(ing) that storytelling can serve as an effective method for fostering change'. Grace tested this theory in an agricultural context using a mixed-methods (qualitative and quantitative) study testing the effects of story-based versus information-based treatments in promoting positive change. The thesis concluded that story-based extension was more effective in delivering change, with the story characteristics required found to include a first-hand personal view of the subject matter, vivid language used in describing the scene and action in order to evoke emotional response, and a tone which allowed the reader/listener to relate to the perspective of the story narrator.

Grace worked with students drawn from both Virginia Tech's agricultural college as well as non-ag students from their College of Liberal Arts and Human Sciences and delivered information in four treatments:

1. Listening to a story told by a storyteller.
2. Reading the same story individually and silently.
3. Listening to a didactic lecture containing the same basic information but not in story form.
4. Individual and silent reading of fact sheets containing the same information.

The creative non-fiction story developed featured a young man's unplanned visit to an intensive livestock farming business and his interactions with the local community in learning about the economic, environmental, animal welfare and social effects of this type of farming. He struggles to rationalise the information and consequently has to rethink his position. Notably, the oral presentation of this story was delivered by a young and charismatic man, who was authentic to the young audience and could thus stimulate an emotional response from them (Grace 2011).

Having analysed the responses to all four treatments and dissected it based on the audiences' backgrounds (ag vs non-ag), the research concluded that there was a 'moderate, statistically significant effect' (Grace 2011, p. 116) for the Story-based treatment groups, but not for the Information-based treatments. There was no effect for oral vs read treatments for both story-based and information-based treatments. Having applied a range of statistical analyses – ANOVA, split file analysis, paired sample t-test, split file ANOVA, multi-variant analysis – Grace scored the change groups on a scale of -1 to 1, with 0 representing the measure of their views prior to treatment, based on a participant survey. Those in the highest-change quartile, which were most influenced by storytelling, shifted between +0.25 to +0.76 from their original attitudinal scores; those in the lowest change quartile (lectures, fact sheets or strongly entrenched views) actually shifted away from the desired objective of the communications by a factor of -0.6 to -0.12. Grace (2011, p. 117) concluded:

These results provide evidence in support of the study hypothesis that Story-based treatments would have a greater effect on positive changes in attitudes toward sustainable agriculture among the study population than would Information-based treatments.

When the results were segmented according to the demographic groupings, the greatest degree of change was elicited from the non-agricultural students exposed to the story-based treatments. From the point of view of persuading people with strong preconceptions of agricultural practices (i.e. the ag students, particularly those who had previously visited and understood intensive livestock production systems), the trial revealed that storytelling was the most effective method of changing attitudes, but its impact was diminished by the strong pre-existing views that were being challenged. That said, storytelling was the only method that elicited any change in views from the agricultural students - information-based treatments were not effective (Grace 2011).

Therefore, the key takeaways from the article were that storytelling was particularly effective in persuading people of a non-agricultural background (think bridging rural-urban divides); and that information-based campaigns are largely ineffective when trying to persuade students with a strong agricultural affinity to change entrenched views - only storytelling delivered a statistically significant change response in this group. In this study, students who had visited intensive livestock operations more than three times were the most resistant to change.

Grace (2011, p. 43) noted that the psychology of narratives contends that for a drama to be effective in fostering change

it must be compelling enough to cause awareness of persuasive content to fade into the background'. That is, the story is so powerful that the reader/listener/viewer 'suspends their disbelief'.

Different results may have been achieved with a more/less powerful story or storyteller (p. 129):

Participants in the Story-based treatment groups reported experiencing a far greater number and more extreme emotional reactions than participants in the Information-based treatments.

Grace also concluded that this does not mean Information-based treatments are ineffective - it all depends on the audience and their pre-existing knowledge and attitudes (p. 129).

If you have an audience that is open to the subject you are discussing, both Information and Story-based treatments may produce change. On the other hand, if you have an audience that is resistant to your message, Story-based treatments would be a far better choice.

Grace did not comment on the likely effectiveness of this method when applied to farm owners or managers of different age or demographic categories. However, Grace (2011) provided a 'roadmap' for extension practitioners to apply the method and recommended that 'it should be used far more often by individuals and organisations whose mission is to promote positive change in economic, social, environmental and animal welfare conditions' (p. 134).

Supporting evidence

The use of storytelling for the purposes of persuasion is confirmed in an article on 'Literary character', in which Sleek (2014) detailed several studies that demonstrate how literary fiction can affect 'social skills, emotional intelligence and behaviour throughout life'. Specifically, he cited a study by Djikic et al. (2009) which compared the response of two groups: one group read 'The lady with the dog', a short story by Anton Chekhov about an affair between a Russian banker and a woman he meets while on vacation; the second group read the same tale re-written in the style of a non-fictional report. Sleek (2014) concluded:

The researchers found that the people assigned to the 'art' condition showed more changes in personality traits compared with those who read the nonfiction version of the story. What's more, each person's change was unique, affected by the emotions he or she was feeling while reading.

Although not dealing directly with persuading farmers to change behaviour or practices, articles relating to the use of storytelling in agricultural research or political contexts have been identified. Research Leader at the US Department of Agriculture Philip Heilman (2016, p. 53) posits that agricultural researchers should embrace storytelling for the purpose of securing new research funding from the US Congress:

...those responsible for maintaining long-term watershed research programs should not try to provide rigorous economic justification. Rather the effort should recognise the natural human tendency to relate to the world through stories, and develop stories so that stakeholders can see their 'stake' in supporting both ongoing and emerging watershed research.

He argues that storytelling is an effective means of persuasion and to be effective, storytelling should feature conflict, emotional connection, novel and memorable action, and be persuasive enough to motivate action.

Lush's (2017) study through The Winston Churchill Memorial Trust of Australia revealed the results of Heilman's recommended approach when she interviewed the American Farm Bureau Federation (AFBF) on their techniques for farmer advocacy. The AFBF advocated the effectiveness of using 'real-life stories' delivered by farmers as resonating with consumers and law-makers. To assist in successfully persuading their audience, the AFBF gave their members a formula drawn from Pixar's *22 rules for storytelling* (Koo 2012) for use when lobbying Congress in eight-minute sessions. The formula provided a framework for farmers to fill in the blanks with descriptions of their own situation and progressing that towards a crisis and a request for help in resolving the issue. The formula (Pixar Rule 4) is: Once upon a time there was _____. Every day, _____. One day _____. Because of that, _____. Because of that, _____. Until finally _____. According to Lush (2017, p. 25) the results were:

Half of a group used the Pixar formula, the other half did not. Those who used it stayed on message, delivered 'the ask' and were very confident in what they were doing as part of the visit. The other half were not comfortable, mis-stated numbers, didn't tell their story, and never made 'the ask'.

Storytelling in other industries

Four papers from the field of health and medical research endorsed storytelling's effectiveness in driving change: Greenhalgh (2001), Hunter & Hunter (2006), Easton (2016), and Rose et al. (2016). Greenhalgh (p. 818) quotes Kathryn Montgomery Hunter 1993 book, *Doctors' stories: the narrative of structure of medical knowledge*, as stating 'neither biology nor information science has improved upon the story as a means of ordering and storing the experience of human and clinical capacity'.

Hunter & Hunter (2006) evaluated oral storytelling, specifically the sharing of personal experiences, as an educational tool among midwifery students and found participants believed the method 'was helpful in gaining cognitive insight and emotional clarification about midwifery situations' (p. 275) and that it was an 'important way to set the tone for the didactic material that followed' (p. 276). Similarly, Easton (2006, p. 1) found that among students of medicine storytelling enhanced learning through the provision of a 'relevant context for understanding, engaging learners and promoting memory' as well as 'promoting humanistic aspects of medicine'.

In contrast, he noted (p. 2) that as a method for delivering information, there was little evidence that traditional academic lectures 'have any role in modifying behaviours or values or inspiring interest, and there is a danger that learners can be overwhelmed by a large volume of information for which they have no context'. This is supported by Grace's (2011) trial which found lectures the least effective means of persuasion. Pacin & Oesterheld (2015) report that direct delivery by farm advisers or by other farmers was an effective method for delivering technical information, demonstrating the need for consideration to be given to the persuasive aspect of storytelling in a broader context that includes other methods of extension.

Commercial storytelling

Evidence of storytelling's effectiveness has strong roots in commercial product advertising. Lacoste & La Rocca (2015, p. 143) posit that 'buyers are not merely passive listeners of salespersons' stories, but actively participate in the storytelling process by initiating, interrupting, complementing or disseminating these stories'. Pera et al. (2016, p. 46) discusses how brands are built around a character archetype with which the target customer identifies and:

unconsciously (and possibly consciously) desire(s) to experience... The power of identifying a brand with one of these timeless stories is that the story already exists deep within our subconscious - it does not need to be created. The task for the brand is to simply evoke the story with cues.

This approach aligns with Carl Jung's Archetype Theory (which drew on the thinking of other philosophers including Plato), which states that all narratives employ archetypes to personify

behaviour patterns - e.g. hero, villain, ruler, sage - with whom the observer might resonate emotionally.

Commercial storytelling's successful application is explained by marketers through Narrative Transportation Theory which states that when people lose themselves in a story, their attitudes and intentions change because of empathy for the characters. Delgado-Ballester & Fernandez-Sabiote (2016) cite evidence demonstrating that it is for this reason storytelling is more memorable and persuasive than other methods of communication. In this instance, citing Green & Brock (2002), they state (p. 120):

Narrative processing results in less critical analysis of ad arguments, fewer negative thoughts and greater affective responses compared to analytical processing, which in turn enhances persuasion.

Green & Brock (2002) posit the effectiveness is built on the 'transportation' of the audience into the story through imagery (descriptive language), identification with characters and narrative structure, which result in the suspension of disbelief thereby stimulating a cognitive response.

Applying storytelling to facilitate extension of research results

What does the use of storytelling look like in the context of articulating scientific research? According to Petit et al. (2011, p. 399), it is a challenging situation for research scientists because the opportunity to elaborate on a subject in this way has 'nothing in common with "standard" scientific discourse based on external criteria known and accepted by the scientific community'. It requires the messenger to be liberated simply through the act of speaking, which triggers a natural capacity to construct a narrative. This in turn can draw out knowledge that may have otherwise remained unsaid. Petit et al. states (p. 399) that:

Telling a story of one's research means showing it as it unfolds, along with all the elements necessary to conduct it, regardless of its nature. It means mixing ideas and events, descriptions, interpretations and justifications, commitments and emotions... Through their stories, the researchers showed that the surprises lie not only in their scientific discoveries, but also (perhaps above all) in the contexts that made such discoveries possible.

The genre challenges the constructs of traditional scientific literature, but also enhances science through exposing the processes of revelation through story. However, the application of this method raises practical and ethical questions for science communication and agricultural extension practitioners as to when and how to use creative non-fiction storytelling. Future examination should be considered of questions such as: what preparatory work is required to segment audiences to identify those individuals or groups receptive to this genre (Greenhalgh 2001); how can it fit within existing extension systems; how should information-based methods be created to complement storytelling and vice versa; and how to ensure the ethical application of creative non-fiction storytelling to retain factual integrity and avoid unintended consequences of misinterpretation or deliberate misrepresentation of information for political or propaganda purposes. As noted by Grace (2011), the charisma of the storyteller can add to the persuasiveness of creative non-fiction storytelling; this may open the possibility of misuse by agricultural snake oil salesmen. In considering how to apply the method ethically, Doubleday & Connell (2017, p. 1) warn that this 'X factor that captures the reader's imagination' should not be confused with sensationalism or 'superlative-rich hyperbole'. They suggest amendments to scientific reporting style guides to assist in the delivery of 'accessible and accurate' information through stories.

Pending future research in this field, consideration may need to be given to a set of guidelines for extension practitioners, in the same way that the commercial advertising sector is governed by rules set and enforced by the Australian government's Ad Standards agency.

Conclusion

All the academic and industry papers identified conclude that storytelling is an effective means of stimulating an emotional response strong enough to drive a behavioural change among a significant proportion of an audience, even those most resistant to change. Rose et al. (2016, p. 52) concluded that the use of stories, and how readers/listeners interact with them, should be 'key considerations for organisations aiming to shift culture'. Recognition of this evidence, as presented by the literature, will be an important first step for Australian agriculture to address its challenge of increasing the rate of R&D uptake and overcoming low willingness to change in sectors such as livestock.

Ironically, it may require storytelling techniques to persuade research and extension agencies to consider this methodology - Easton (2016, p. 9) noted that in his medical education research, the term 'storytelling' carried negative connotations of children's 'bedtime reading' and that a 'more sophisticated name' for the process may be needed.

The available literature was also clear in noting that storytelling should not be undertaken at the expense of other communication methods. According to Greenhalgh (2001, p. 819), stories should be used in a targeted way to 'supplement, rather than replace, other forms of learning or training'. Greenhalgh also cautioned that 'more evidence is required about the precise benefits of storytelling as an educational tool' and until that is obtained it should not be viewed as a panacea to behavioural objectives.

It is clear from the dearth of literature assessing the performance of storytelling as a means of changing the views of agriculturalists towards uptake of new research and technology, that there is ample room for agricultural RD&E agencies to test this methodology. In doing so consideration should be given to the many and varied reasons farmers have for adopting or not-adopting new practices and technologies, and the practical and ethical implications of using a powerful persuasive tool like creative non-fiction storytelling to overcome these barriers.

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