

## Research article

# What makes scientific journal articles appeal to Human Factors and Ergonomics professionals?

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## Abstract

**Background:** Human factors and ergonomics (HF/E) is an applied discipline and a profession that demands ecologically valid and practical research. However, there is concern that while HF/E research may be meeting the needs of researchers, it may not have fully met the needs of practitioners nor made a high impact on practice in the 'real world'. This suggests that there may be a discordance between what researchers and practitioners perceive as important in HF/E research publications. **Aim:** Sternberg and Gordeeva examined journal articles characteristics that may have an impact in psychology. The current study aimed to determine the characteristics that make scientific journal articles appeal to HF/E researchers and practitioners. **Method:** Participants were recruited for a web-based questionnaire via appeals to 47 IEA-federated HF/E Societies, 'invitation to participate' notices on LinkedIn HF/E groups, and individual emails to LinkedIn members and professional contacts. **Results:** Well-written and reader-friendly journal articles are appreciated across disciplines, regardless of work roles. HF/E researchers and practitioners place a higher importance on the practical significance of journal articles than psychologists, and this is particularly important for HF/E practitioners.

**Conclusion:** This research has provided an insight into the attributes that HF/E researchers and practitioners look for in a good journal article, providing guidance for authors on how to better tailor their publications to the needs of their intended audience. HF/E researchers and practitioners may be more similar than expected in what they believe to be important journal article attributes.

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## Background

The relationship between research and practice in human factors and ergonomics (HF/E) is so fundamental that it is explicitly captured in many definitions of the discipline. Wilson [1, p. 560], for instance, defined ergonomics as *"the theoretical and fundamental understanding of human behaviour and performance in purposeful interacting sociotechnical systems, and the application of that understanding to design of interactions in the context of real systems"*. This definition captures the complementary relationship between research and practice. However, a number of figures in the discipline have questioned the verity of this relationship. Meister [2, p. 258] agreed that research and practice *"should be indivisible, but in Ergonomics, at least the kind I practice, they are often quite separate"*. Indeed, such sentiments have been evident over the past 50 years.

A widening gap between researchers and practitioners has been observed in many disciplines. This phenomenon has been termed in various disciplines the 'research-practice gap' [3] and 'researcher-practitioner divide' [4]. This gap especially concerns research published in academic journals, and impacts the application of research in practice. Many disciplines such as industrial, work and organisational (IWO) psychology, library and information science, and healthcare have identified the common problem that practitioners often do not implement research findings and researchers often do not address questions relevant to practitioners [5]. Throughout this paper, the term 'practice' refers to an

individual's role in HF/E, and 'application' refers to the application of an understanding of human behaviour and performance in purposeful interacting sociotechnical systems to design of interactions in the context of real systems [1].

The research-practice gap issue has profound and wide-ranging implications for the adequacy of HF/E research and the implementation of research findings into practice. There has been very little research on this important issue in HF/E, and yet the history of HF/E is replete with references from the early 1960s to a schism between researchers and practitioners [6, 7]. The limited literature in HF/E on the research-practice relationship contrasts with much larger body of literature in other fields, and suggests that more data on the issue is badly needed. Meister's [6] original research represents a rare attempt to examine the issue in depth. Using a survey of 46 of the most experienced members of the Human Factors and Ergonomics Society (HFES), Meister [6] found that practitioners considered research published in HF/E journals to be largely irrelevant to practitioner problems. Thus Meister asserted that *"HFE research is not useful to what should be two of its primary consumers: the practitioner and designer working in system development... Simply phrased, the discipline has done a rotten job of applying its research to real-world problems"* [6, p. 264].

More recently, an international survey of HF/E practitioners conducted by Chung and Shorrock [8] found, not surprisingly, that those working in academic/research institutions read significantly more journal articles per month compared to

those working in other organisations (e.g. private sector, government, non-profit). The ‘researchers’ also rated HF/E journals as a whole as significantly more useful to them compared to the ‘practitioners’. Further, the authors found that some of the strongest barriers to research application in practice were related to the low applicability and practicality of the research. Thus, it appears that while the research products generated in HF/E may be meeting the needs of researchers, they may not have fully met the needs of practitioners in the industry, nor made a high impact on practice in the ‘real world’. This suggests that there may be a discordance between what researchers and practitioners perceive as important in HF/E research publications.

A study conducted by Sternberg and Gordeeva [9] examined the characteristics of journal articles that may have an impact in the field of psychology. The authors compiled a list of 45 characteristics of articles from 20 psychologists, and then surveyed 252 psychologists (all held doctorates in psychology) to rate the importance of these characteristics on a six-point scale from ‘Not at all important’ (1) to ‘Extremely important’ (6). The authors conducted a Principle-Components Analysis on the items, which yielded six factors: 1) *Quality of Presentation*, 2) *Theoretical Significance*, 3) *Practical Significance*, 4) *Substantive Interest*, 5) *Methodological Interest*, and 6) *Value for Future Research*. However, respondents were recruited from the American Psychological Society, which tends to attract psychologists with interests directed toward research. This research focus was evident in the items that received the highest mean ratings e.g. ‘Presented results are of major theoretical significance’, ‘Generates new research’. Thus it appears that their findings were biased towards researchers.

The current study aimed to extend Sternberg and Gordeeva’s [9] research in psychology into the HF/E discipline, and to determine the characteristics that make scientific journal articles appeal to HF/E researchers and practitioners via an international survey. We hypothesised that those who spend proportionately more work time in research would place importance on different characteristics compared to those who spend proportionately more work time in practice.

## Method

### Questionnaire Development and Format

Attributes were selected from a list of 45 from Sternberg and Gordeeva’s [9] study, with references to psychology modified to apply more closely to HF/E. Twenty-eight attributes were selected based on the criteria of a loading of greater than .55 from Sternberg and Gordeeva’s [9] Principle-Components Analysis. One attribute under the *Substantive Interest* factor with a loading of .50 was kept because there are only three items in this factor.

Following pre-testing, the questionnaire was hosted on [www.surveymonkey.com](http://www.surveymonkey.com). The questionnaire was open to HF/E professionals in both research and practice, and comprised a welcome and information page followed by 15 questions in two sections: Section 1) About you, and Section 2) Attributes of HF/E journal articles. In Section 2, respondents were asked to rate the importance of the 28 statements presented in random order. Each statement represented a possible

attribute of a journal article that may have an impact in the field of HF/E i.e. an article that influence research or practice, or both. Respondents were asked to consider each attribute from the point of view of the discipline and profession, rather than from their own personal point of view. Each attribute was rated on a six-point scale from ‘Not at all important’ (1) to ‘Extremely important’ (6).

### Procedure and Respondents

No universal list of HF/E professionals was available for this type of research. While HF/E Societies do maintain lists of members, these are confidential. Further, it was difficult to define the attributes of an HF/E professional, partly because the profession is not regulated and Society membership is not mandated. Thus it was not possible to determine a total population size.

The following recruitment methods were used to reach as many HF/E professionals as possible:

1. **HF/E Societies.** The Presidents and Secretariats of each of the 47 International Ergonomics Association (IEA) Federated Societies were contacted in May 2011 to request that their Societies invite their members to complete the survey.
2. **LinkedIn Groups.** A notice entitled “Survey of HF/Ergonomics Professionals: Appeal for Participation” was posted to members of 19 groups associated with HF/E on the professional networking website [www.linkedin.com](http://www.linkedin.com). Additionally, 203 members of these groups were sent the invitation individually via LinkedIn email (i.e. members that could be contacted by email and indicated that they practised HF/E).
3. **Professional contacts.** 631 professional contacts (375 contacts from a previous study who indicated that they were willing to be contacted for a follow-up study, and 256 corresponding authors from the journals: *Human Factors*, *Ergonomics*, and *Applied Ergonomics*) were contacted by regular email and asked to complete the survey, and to forward the invitation to their own HF/E colleagues.

Respondents could choose to complete the questionnaire anonymously, or leave their email address (on the questionnaire or separately by email) to receive the results. There was no material incentive to complete the questionnaire.

## Results

A total of 260 usable questionnaires were submitted from respondents. Of these, data from 52 respondents were excluded for the following reasons: not currently employed ( $n = 3$ ); percentage of work time spent in research and application not stated ( $n = 6$ ); spent < 25% time in both research and application in the last 12 months ( $n = 18$ ); and spent an equal amount of time in research and application in the last 12 months ( $n = 25$ ). Data from these respondents were excluded because the aim of the current study was to examine the difference between individuals who either worked predominantly in research or in practice in the last 12 months. Thus data from 208 respondents were used for the analysis.

**Table 1.** Key demographic categories from 1st (most frequent) to 5th

	1st	2nd	3rd	4th	5th
Organisation types	Academic/ Research institution 25.5%	Private sector org – not consultancy 20.2%	Government org/ agency/ dept. 18.3%	Private sector consultancy 14.4%	Self-employed/ Independent 13.0%
Countries of work	US 35.1%	UK 17.8%	Canada 9.6%	Australia 9.1%	Switzerland 2.9%
Highest qualification	Postgraduate – Certificate/ Diploma/ Master degree 48.6%	Postgraduate – Doctorate degree 40.9%	Undergraduate – Bachelor degree 9.6%	Other 1.0%	N/A
Area of highest qualification	HF/E 58.7%	Psychology 22.1%	Engineering/ Computing 6.7%	Sports/ Movement Science 2.9%	Design; Biol./Anat./ Physiol./ Med. 1.4%
Society memberships	US 42.3%	UK 22.6%	Canada 7.2%	Australia 3.8%	Switzerland 2.4%
Industries	Transport & storage 40.9%	Defence 29.3%	Manufacturing 25.0%	Healthcare & social work; Info. & comm. 24.0%	Education 19.7%
Application areas	Displays, controls & HCs 39.9%	Workplaces & furniture 30.8%	Safety management 30.3%	Tasks, jobs & work processes; HF/E method / tool development 28.8%	Training 21.6%

**Note:** Most rows do not add up to 100% because only the top five responses are listed and some questions allowed multiple responses.

**Demographics**

The respondents represented 32 countries and a wide range of organisational types, qualifications, industries and application areas. The key demographic categories and top five responses are shown in Table 1. Respondents’ estimated work time over the most recent 12 months as an active HF/E professional was split on average as follows: research (mean 27.9%), application (mean 48.1%), education (mean 14.3%), and other (mean 9.9%).

**Attributes of HF/E journal articles**

Respondents were divided into two groups for the following analysis: (1) Researchers: individuals who spend proportionately more work time in research than in practice (*n* = 79); and (2) Practitioners: individuals who spend proportionately more work time in practice than in research (*n* = 129). Table 2 shows the highest qualifications of the HF/E researchers and practitioners in the sample. A majority of respondents in the sample have attained a postgraduate qualification. Sixty percent of the researchers are qualified to the doctorate level and 34.2% have attained a postgraduate certificate, diploma or masters degree. Thirty percent of the practitioners are qualified to the doctorate level and 57.4% have attained a postgraduate certificate, diploma or masters degree.

**Table 2.** Highest qualifications of HF/E Researchers and Practitioners

Highest Qualifications	Researchers		Practitioners	
	n	%	n	%
Postgraduate - Doctorate degree	47	59.5	38	29.5
Postgraduate - Certificate/ Diploma/ Master degree	27	34.2	74	57.4
Undergraduate - Bachelor degree	4	5.1	16	12.4
Other	1	1.3	1	0.8

Table 3 presents the attribute ratings of HF/E professionals versus Sternberg and Gordeeva’s [9] respondents, and the six factors that were derived from their Principle-Components Analysis. HF/E researchers and practitioners in this sample shared nine out of the top 10 attributes, albeit in a different order of importance. Six of these shared top 10 attributes were from the *Quality of Presentation* factor: “The problem is clearly stated and well-conceptualised”, “Well-written, well-structured, and well-organised”, “Results of analysis are presented clearly and discussed carefully with tight, logical reasoning”, “Has a logical flow and organisation of ideas”, “The writing is succinct and internally consistent”, and “Hypotheses are clearly stated and testable”. Two of the shared top 10 attributes were from the *Practical Significance* factor: “Contains useful implications for professional practice” and “Results are of major practical significance”. However, these attributes were much more important to practitioners compared to researchers (ranked as the top two attributes for practitioners). For the top 10 attributes that were not shared across the groups, “Includes concrete examples” (*Practical Significance* factor) was ranked as 7th for practitioners and 14th for researchers, and “Contains useful implications for future research studies” (*Value for Future Research* factor) was ranked as 21st for practitioners and 9th for researchers.

HF/E researchers and practitioners in this sample shared seven out of the bottom 10 attributes. Although the overall order of these shared attributes was different for each group, many of the items were ranked similarly. Four of the shared bottom 10 attributes were from the *Theoretical Significance* factor: “Presents a useful new theory or theoretical framework”, “Presented results are of major theoretical significance”, “Integrates many different areas of data previously thought to be unrelated or poorly explained”, and “Debunks an existing theory or way of thinking”. Two of the shared bottom 10 attributes were from the *Methodological Interest* factor: “Demonstrates a useful experimental paradigm” and “Presents an experiment with a

**Table 3. Attribute ratings of HF/E professionals vs. Sternberg & Gordeeva's respondents**

Factor*	Attribute	Researchers			Practitioners			Sternberg & Gordeeva†		
		Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD
Q	The problem is clearly stated and well-conceptualised	1	4.95	0.94	4	4.89	0.98	5	4.33	1.33
Q	Well-written, well-structured, and well-organised	2	4.88	0.95	6	4.84	0.93	7	4.28	1.26
Q	Results of analysis are presented clearly and discussed carefully with tight, logical reasoning	3	4.85	0.93	3	4.95	0.84	4	4.43	1.25
S	Topic is interesting and important	4	4.81	1.09	5	4.88	0.88	6	4.29	1.17
Q	Has a logical flow and organisation of ideas	5	4.69	0.96	8	4.73	1.05	13	4.05	1.29
P	Contains useful implications for professional practice	6	4.67	1.21	1	5.07	0.94	27	2.87	1.40
P	Results are of major practical significance	7	4.61	1.23	2	5.06	0.92	19	3.74	1.45
Q	The writing is succinct and internally consistent	8	4.55	1.03	9	4.63	1.00	11	4.13	1.31
V	Contains useful implications for future research studies	9	4.41	1.31	21	3.95	1.21	9	4.25	1.10
Q	Hypotheses are clearly stated and testable	10	4.34	1.18	10	4.57	1.12	10	4.14	1.30
V	Contains useful implications for a scholarly understanding of the field	11	4.30	1.05	22=	3.90	1.22	15	4.03	1.15
S	Captures reader's interest	12	4.29	1.27	11	4.41	1.16	18	3.79	1.34
Q	Tone is unbiased and impartial	13	4.25	1.17	13	4.38	1.35	26	3.17	1.45
P	Includes concrete examples	14	4.20	1.24	7	4.75	0.94	28	2.32	1.26
V	Contains useful recommendations for changes or modifications in accepted theoretical constructs	15=	4.15	1.13	12	4.39	1.12	12	4.10	1.09
T	Provides a better explanation of existing phenomena	15=	4.15	1.15	17	4.13	1.15	8	4.26	1.02
V	Contains useful recommendations for further research or for changing research methodology	17	4.13	1.29	22=	3.90	1.28	16	3.98	1.10
Q	Starts and ends strongly, attracting attention and interest from the first paragraph and ending with clear take-home message	18	4.08	1.28	14	4.28	1.18	20	3.72	1.37
T	Presents a useful new theory or theoretical framework	19	4.05	1.24	19	4.02	1.27	2	4.79	1.18
P	Is clearly understandable to a broad cross-section of HF/Ergonomics professionals <sup>^</sup>	20	4.04	1.26	15	4.26	1.22	25	3.40	1.39
T	Presented results are of major theoretical significance	21	3.96	1.26	24	3.87	1.12	1	4.91	1.11
M	Presents a new and useful test or technique	22	3.91	1.27	16	4.20	1.09	21	3.70	1.21
M	Demonstrates a useful experimental paradigm	23	3.73	1.20	26	3.67	1.13	22	3.68	1.13
T	Integrates many different areas of data previously thought to be unrelated or poorly explained	24	3.63	1.34	20	3.99	1.23	3	4.56	1.14
S	Appears at the right moment, when people are ready to hear the message	25	3.55	1.35	25	3.81	1.39	14	4.03	1.54
P	Is applicable to work in many areas of HF/Ergonomics <sup>^</sup>	26	3.44	1.42	18	4.05	1.36	24	3.46	1.49
T	Debunks an existing theory or way of thinking	27	3.42	1.46	27	3.48	1.47	17	3.88	1.39
M	Presents an experiment with a particularly clever paradigm or experimental manipulation	28	3.34	1.45	28	3.16	1.30	23	3.48	1.18

\*Sternberg & Gordeeva's factors: (Q) = quality of presentation; (T) = theoretical significance; (P) = practical significance; (S) = substantive interest; (M) = methodological interest; (V) = value for future research.

† Sternberg and Gordeeva's study had 45 attributes; the ranks shown here represent the order of the selected 28 items rather than the original rank.

<sup>^</sup>Wordings changed from 'psychologists' to 'HF/Ergonomics professionals' and from 'psychology' to 'HF/Ergonomics'.

particularly clever paradigm or experimental manipulation"; and one of the shared bottom 10 attributes was from the *Substantive Interest* factor: "Appears at the right moment, when people are ready to hear the message". For attributes that were not shared across the groups, two of the bottom 10 attributes for practitioners from the *Value for Future Research* factor ("Contains useful implications for a scholarly understanding of the field" and "Contains useful recommendations for further research or for changing research methodology") were ranked relatively much higher by researchers. Similarly, two of the bottom 10 attributes for researchers from the *Practical Significance* factor ("Is clearly understandable to a broad cross-section of HF/Ergonomics professionals" and "Is applicable

to work in many areas of HF/Ergonomics") were ranked relatively much higher by practitioners.

HF/E professionals in the current study and psychologists in Sternberg and Gordeeva's [9] study shared four out of the top 10 attributes, and these were ranked similarly. Three of the shared top 10 attributes were from the *Quality of Presentation* factor ("Results of analysis are presented clearly and discussed carefully with tight, logical reasoning", "The problem is clearly stated and well-conceptualised", and "Well-written, well-structured, and well-organised"), and one was from the *Substantive Interest* factor ("Topic is interesting and important"). Overall, in contrast to HF/E professionals, psychologists rated attributes from

the *Theoretical Significance* factor to be much more important than attributes from the *Practical Significance* factor. Whereas psychologists ranked attributes from the *Theoretical Significance* factor (“Presented results are of major theoretical significance”, “Presents a useful new theory or theoretical framework”, and “Integrates many different areas of data previously thought to be unrelated or poorly explained”) as the most important, HF/E professionals ranked these attributes in the bottom 10. Conversely, whereas psychologists ranked attributes from the *Practical Significance* factor (e.g. “Results are of major practical significance” and “Contains useful implications for professional practice”) as among the least important, HF/E professionals ranked these attributes in the top 10.

## Discussion

Overall, HF/E researchers and practitioners have similar views on what attributes are important to them in a journal article. Both groups agree that the quality of presentation (i.e. clear and well-structured writing) is crucial to a good article. This accords with the finding in Chung and Shorrock’s [8] study, that one of the top suggestions on ways to bridge the research-practice gap was reporting research in a more understandable, clear and readable manner. Their respondents suggested that researchers should adopt a reader-friendly writing style using plain language and less scientific jargon in articles to ensure that professionals both within and outside of their industry can easily understand the research findings. HF/E researchers and practitioners also agree that some attributes related to theoretical significance (i.e. relating to new and existing theory) and methodological interest (i.e. relating to the experimental paradigm) are not as important for an article to have impact in the field. The main difference was that practitioners tended to rate attributes relating to practical significance more highly compared to researchers. The practical application of research findings is an obvious concern for practitioners. This accords with another top suggestion for researchers regarding the need to ensure that the research focus and methodology are relevant to the organisational environment [8].

Results of the current study are in direct contrast with the findings of Sternberg and Gordeeva’s [9] study. Whereas the psychologists in their study tended to favour theoretical significance, HF/E professionals in the current study tended to favour practical significance. One in five in the HF/E sample had a psychology background, and 59% of these professionals also hold a doctorate in psychology. Although similar in educational attainment, the psychologists’ interest in theoretical significance was much stronger than the HF/E researchers in the current study. Thus despite the criticisms about the lack of practicality and applicability of HF/E research over the past 50 years, HF/E researchers actually do value the practical significance of journal articles. This might be due to the fact that HF/E is fundamentally an applied discipline and a profession that demands ecologically valid and practical research [10], and hence there may be more emphasis on the practical significance of research in the HF/E discipline compared to the psychology discipline. However, it is interesting to note that the psychologists in

Sternberg and Gordeeva’s [9] study also valued the quality of presentation of a journal article. Thus it appears that well-written journal articles are universally appreciated across disciplines, regardless of the amount work time spent in research or practice. Overall, it appears that there is less difference between researchers and practitioners in the HF/E discipline than between researchers across the HF/E and psychology disciplines.

## Conclusion

This research has provided an insight into the attributes that researchers and practitioners look for in a good journal article, and hence provide guidance for authors on how to better tailor their publications to the needs of their intended audience, as well as to journal editors and reviewers on what to look for in selecting articles for publication. Well-written and reader-friendly journal articles are widely appreciated across disciplines, regardless of work roles. HF/E researchers and practitioners place a higher importance on the practical significance of journal articles than psychologists, and this is particularly important for HF/E practitioners. Thus HF/E researchers and practitioners may be more similar than expected in what they believe to be important journal article attributes.

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