Tailoring Patient Information to Encourage Patient Engagement

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Abstract

This paper proposes a new method for tailoring health information based on an individual's dominant attitudes and information processing style which can be digitally operationalized and delivered direct to the patient. This individualized approach is based on principles previously used as the basis for mass-marketing campaigns, including smoking and other public health issues - but not previously used for structuring treatment recommendations in individual patient consultations. In previous work we have shown that patient understanding of their medical condition is influenced by whether a medical report is expressed in their preferred information processing style or expresses their dominant motivational attitude. In this work we build on these findings to examine the connection between a patient's perceived understanding of the content of a medical report and their willingness to actively engage with their doctor. Because engagement has been linked to patient compliance, this has important implications for patient adherence to treatment.

Keywords: Personalisation, health information systems, cognitive style, functional theory

1 Introduction

Growth in chronic diseases, such as diabetes, exacts an enormous cost on health systems worldwide. By 2030, there may be around 47 million Diabetes patients in North America, representing a 42% increase from 2001, and similar growth is expected in other westernized countries (S. Dreyfus, R. Lederman, S. Smith, & P. Monagle, 2011; Lee, 2007; Zimmet, Alberti, & Shaw, 2001). While diet, exercise, and medication can enhance outcomes, poor management inevitably causes serious complications. Unfortunately, non-adherence to medication and lifestyle directives is common (Roy P. C. Kessels, 2003) and is often related to patient understanding of their condition and their doctors instructions.

The quality of communication between doctor and patient and how well patients comprehend treatment information (Roy P C Kessels, 2003) are major determinants of adherence. Studies in social psychology and education indicate that people take notice of and remember information that is easy to read, emphasizes issues that are personally relevant, and is structured to fit the individual's cognitive style (J. S. Evans, 2008). Unfortunately, many doctors struggle to communicate adequately with patients for a variety of reasons, including time and difficulty simplifying highly technical concepts (Larsson, 1987). Moreover, patients often fail to grasp the importance of the behaviours described in the treatment plan or lack motivation to adhere for an extended period (Marshall & Maiman, 1980).

These principles are the basis for message tailoring in mass-marketing campaigns to ensure coverage of as many market segments as possible. For example, anti-smoking health campaigns often use both a story-telling approach and a more scientific fact-based argument. These principles are also relevant for individual communication between doctor and patient, but are yet to be implemented.

In previous work (S Dreyfus et al., 2011), we have found support for two hypotheses based on these ideas: The first of these was that the greater the match between a receiver's preferred information processing style (otherwise referred to in the literature as cognitive style) (Epstein, 1988) and the

style emphasised in a report, the greater the reader's perceived understanding of the content. The defining feature of this theory is the idea that learning and reasoning occur through either experience (observation and activity) or abstract rules via two parallel information processing systems (J. S. B. T. Evans, 2008). In the specific theory we describe here, Cognitive Experiential Self Theory (CEST) (Epstein, 1998), they are labelled the analytical-rational and experiential systems respectively. CEST proposes that everyone uses both systems to learn how to adapt to the environment; however, an enduring trait of each individual is the extent to which we prefer one mode as the default mode of processing (Epstein, 1998). Based on well-established taxonomies, attitudes are associated with four primary functions: utilitarian, value-expressive, knowledge, and ego-defensive (Shavitt, 1989; Snyder & DeBono, 1985).

The aim of this paper is to consider how we can tailor information, which can be then converted into an easily distributed digital format, to present it in a way that matches individual cognitive styles and personal motivational factors. By doing this we aim to increase patients understanding (comprehension) of the content which might lead to improved doctor-patient communication and, potentially, patient adherence to treatment.

Current Design of Patient Information

Most pathology reports, such as in Figure 1, which shows a typical report, are primarily a record of numeric test results for the laboratory and the treating physician. As a result, many patients are effectively deprived of key information about their condition and why a given treatment has been recommended. These interpretation difficulties are believed to be a major impediment to better communication between patients and physicians (Raab, Nakhleh, & Ruby, 2005; Troxel, 2004).

At present, very little research has investigated how to prepare and deliver information in a low-cost automated manner that addresses the needs of medical consumers and fits with individual ways of understanding information and the patients' intention to comply.

Requisition Number: 760145584

PATIENT DETAILS				ACCOUNT DETAILS: Cash	
Patient:	Doe, Jane	Gender:	Female	Date:	02/02/2005
ID:	6509180000001	Age:	44 y	Receipt Number:	Not Available
Postal Address:		Home Tel:	(XXX) XXX-XXXX	Amount:	0.00
		Work Tel:	(XXX) XXX-XXXX	Visit Number:	1
		Cell:	(XXX) XXX-XXXX	Patient Number:	Not Available
				Member Number:	Not Available

Location:	PRETORIA	Collected:	01/02/2005
Referring Doctor:	DEMO PRACTITIONER	Received:	02/02/2005
Tests Requested:	Full Blood Count (FBC);		
Pathologist:	Dr. X. XXXXXX	Reported:	02/02/2005

PRELIMINARY REPORT
HAEMATOLOGY

Full Blood Count (FBC)

Test	Result	Flag	Reference Range	Comment
White Blood Cells-WBC	7.49		4 - 11 10^9/L	
Neutrophils %	23.3	L	43 - 65 %	
Lymphocytes %	51.1	H	20.5 - 45.5 %	

Figure 1: Typical Numeric Based Sample Pathology Results Presentation

Perceived understanding and engagement

The traditional professional-client communication model may also contribute to the patient's lack of confidence when interacting with doctors. Tailoring communication may help address this problem by promoting better interactions: research into the design of educational materials indicates that interactions between students and teachers are more frequent and explore more issues when students understand the personal relevance of the material (Ames, 1992). This principle has been validated in the medical sphere, where patient literacy improved greatly when material was co-developed with

patients to ensure that it emphasised issues relevant to the situations and experiences of those patients (Kandula et al., 2009). On this basis we propose the following research questions:

1. Will a reader report greater understanding of treatment-related information if the consequences of treatment or non-treatment are described in terms of issues that are important to that individual?
2. Is there a relationship between perceived understanding of information and willingness to engage with the information provider (e.g. doctor)?

If our research questions are answered in the affirmative, then producing a tailored medical report for a patient should improve that person's understanding of information about his/her condition and this, in turn, should increase engagement with the medical provider.

2 METHOD

The study is a quasi-experimental design, which assesses comprehension of the contents of a single, randomly allocated, plain-language report. Each participant reported on the extent to which information needs were satisfied. Post-test, participants were categorized according to attitude, information-processing (cognitive) style, perceived understanding and level of patient-doctor interaction using established measures (S. Dreyfus, R. Lederman, S. P. Smith, & P. Monagle, 2011; Epstein, 1998).

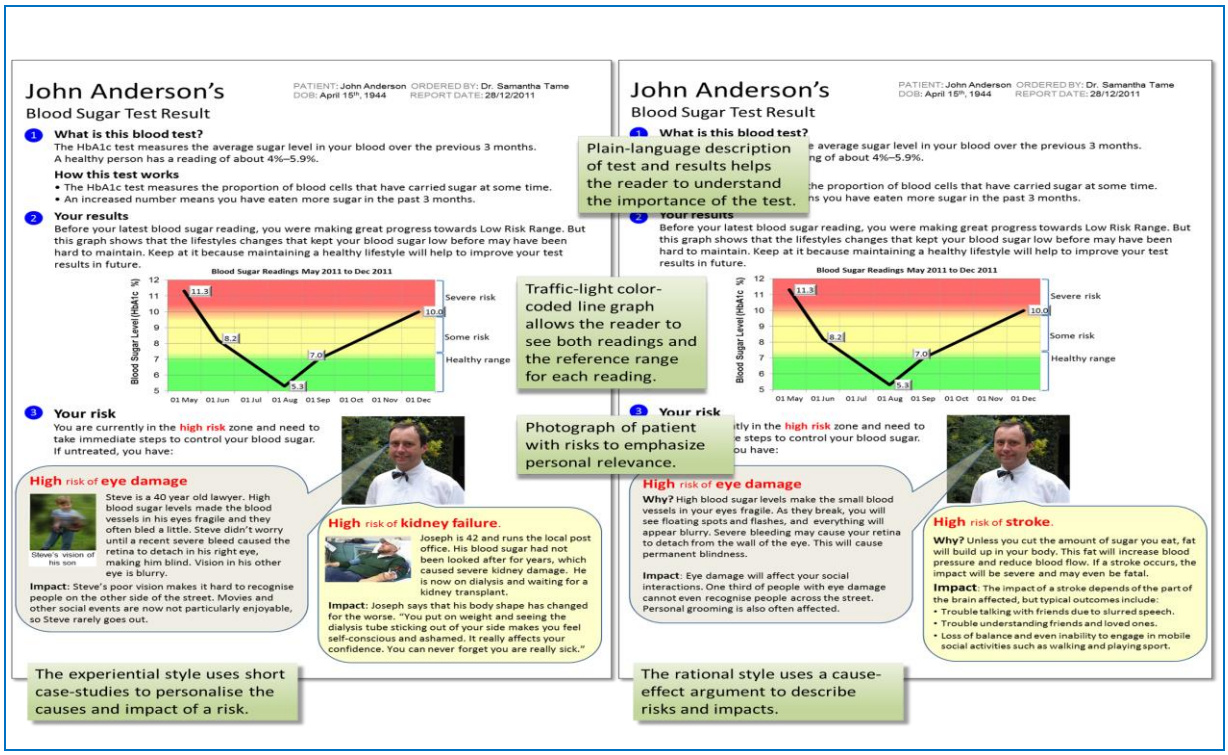

Figure 2: Sample reports for experiential (left) and rational (right) orientations

A fictional disease was used to minimize the likelihood that prior knowledge and experience would bias responses.

Figure 2 shows two of these plain-language reports. Each is designed to appeal to attitudes that serve a value-expressive function, emphasizing self-image concerns. However, the left-hand report supports an experiential style of cognitive processing; it assists learning through vicarious experience rather than logical inference using a storytelling approach that explains the condition and so-

cial implications. The right-hand side is designed to appeal to a rational style of cognitive processing through its use of a cause and effect style of argument.

Description of the experiment

A post-test between-subjects quasi-experimental design with random assignment to treatments was used. The research assistant who ran each session worked with each participant separately to explain requirements in plain language, collect demographic data, and set up the treatment (a personalised report) beforehand, and to ensure all questions on the post-test questionnaire were completed afterwards. Each participant was paid equally, and each viewed only one report design. All sessions were conducted in a university Behavioural Research Laboratory on a computer monitor. After reading the plain language description of the project and signing a consent form, the display was set up for the participant and the following scenario, describing an imaginary disease, was presented:

A few months ago, you began to feel unusually tired and sick and went to your local doctor for a check-up. At the consultation, your doctor took a blood sample and sent it off to a pathology laboratory for testing. The test revealed that you have contracted Bell's disease. This infection damages the pancreas and affects the body's immune system. These effects are usually permanent because damage remains after the initial bacterial infection has been cured. As a result, people with Bell's disease tend to have elevated blood sugar levels, and are prone to colds and infections.

Since your initial diagnosis, a new blood test has been performed each month to track your progress. The sheet you are about to see has been sent by your doctor in preparation for the next visit.

Treatment groups

Each participant then viewed one of four reports (see samples in Figure 3), each detailing blood test results about the status of the same fictitious disease. These reports varied the message style and the type of consequences emphasised. Using the information processing styles described by CEST (Epstein, 1998), each report was structured as either a fact-based argument or a case-study to conform to the needs of the rational and experiential styles, respectively. The consequences of major disease risks were similarly varied to reflect issues that are theoretically of concern to the utilitarian and value-expressive motivational attitudes. Based on extensive pre-testing, work and financial problems were emphasised in the utilitarian-oriented reports, and self-image and social issues in the value-expressive reports. Figure 3 illustrates the different messages used. The top row contains messages designed to appeal to experiential learners, while the bottom row contains messages for rational learners. The left column describes consequences in terms that should resonate with those with a highly value-expressive motivation, and the right describes issues relevant to utilitarians.

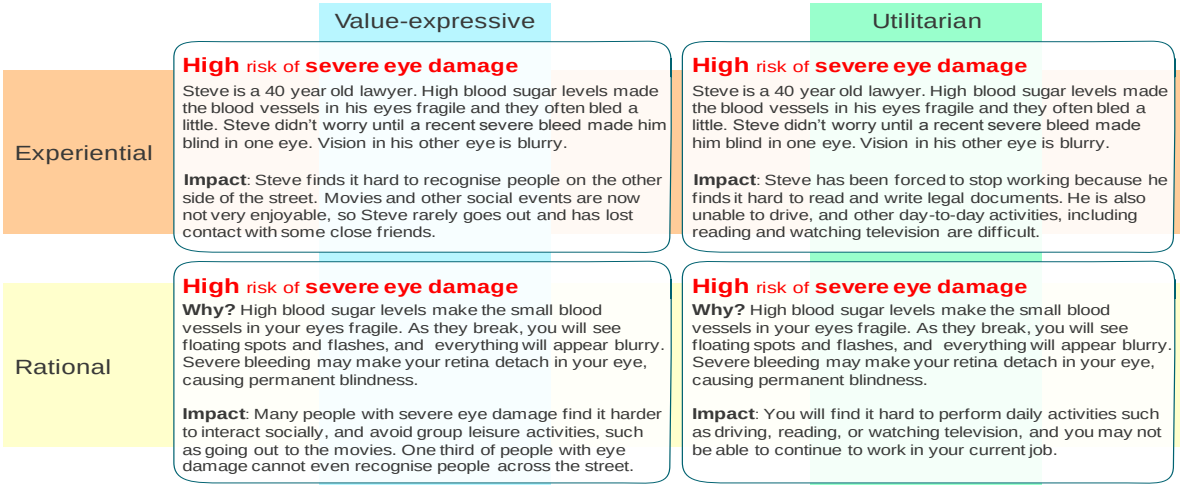

Figure 3: Message styles used in experiment

Participants

The conceptual population chosen was adults fluent in English and with no major chronic health issues. The health issue exclusion was to exclude diabetics because the fictional scenario that participants responded to was a disease somewhat similar to diabetes. As wide a range of ages as possible were recruited to ensure a diverse population. The sample comprises 43 females and 17 males and the typical participant has completed a higher degree. Two thirds of the sample is 25-45.

After subjects were presented with the plain-language reports, they completed a questionnaire containing measures of motivational attitude, preferred IS processing style, rationale-experiential inventory, perceived understanding and patient-doctor interaction intentions.

Motivational Attitude and Preferred Information Processing Style

Motivational Attitude and Preferred Information Processing Style were assessed by established measures described in previous research (withheld under review). Sample questions from these measures are presented in tables 1 and 2.

Utilitarian	Value-expressive
I will manage the condition if that helps me to...	I will manage the condition if that helps me to...
1. improve my health.	1. maintain an image I have of myself.
2. do more things in life.	2. manage what others think about me.
3. improve my quality of life.	3. maintain or increase my self-esteem.
4. avoid or reduce disease complications.	4. achieve an image I have of my ideal self.

Table 1. Motivational attitude scale

Need for Cognition	Faith in Intuition
1. I don't like to have to do a lot of thinking. (Reverse)	1. I trust my initial feelings about people.
2. I try to avoid situations that require thinking in-depth about something. (Reverse)	2. I believe in trusting my hunches.
3. I prefer to do something that challenges my thinking abilities rather than something that requires little thought.	3. My initial impressions of people are almost always right.
4. I prefer complex to simple problems.	4. When it comes to trusting people, I can usually rely on my "gut feelings."

Table 2. Rational-Experiential Inventory

Using these measures, participants were categorised as having generally utilitarian or value expressive attitudes and a generally rational or experiential information processing style.

Perceived understanding

Perceived understanding (Table 3) is based on a measure of perceived understanding used by Smith et al. (2011), modified for the health context. As with the other modified measures, a Q-Sort procedure was used to ensure that all items represented the same underlying concept. This measure assesses issues of current and future concern, the general impact of the disease, and how it affects the person specifically.

I feel informed about...
1. How the disease affects health over time.
2. How the disease is currently affecting my health.
3. How my lifestyle will change over time.
4. How my symptoms are likely to change over time.
5. How well I am currently managing the disease.

Table 3: Perceived understanding

Interaction engagement

The Smith-Falvo Patient-Doctor Interaction Scale (PDIS) (Donna R. Falvo & Jana K. Smith, 1983) was used to measure the participant's feelings of confidence and control in interactions with a physician. The Smith-Falvo interaction scale (D. R. Falvo & J.K Smith, 1983), derived from a large-scale study of patient preferences for different types of physician behaviours, is designed to assess the quality of the interaction between the patient and the physician The measure is similar to Bandura's measure of self-efficacy (Bandura, 1977), but is specific to the patient-doctor relationship. The attitudes measured are important therapeutically in that patients who feel confident interacting with their physician have longer and more frequent meetings, and those who feel in control of their decisions are more likely to take ownership of their situation and manage their condition more actively.

After receiving this information about my condition…	
1. I will ask more questions.	5. I will be more assertive in interactions with my doctor.
2. I feel more in control.	6. I will be able to talk more confidently about my condition with other people.
3. I will feel more confident talking with my doctor.	7. I feel more able to question why a particular treatment has been recommended.
4. It is clearer what sorts of issues I need to discuss.	8. I feel more confident questioning the doctor about whether the treatment is right for me.

Table 4: Smith-Falvo Patient-Doctor Interaction Scale

3 Results

The research model was operationalized in structural equation model format, and relationships between latent variables assessed using Partial Least Squares (PLS) analysis. Inter-construct correlations, the coefficient of determination, composite reliability (ρ_c), Cronbach's alpha, average variance extracted (AVE), and redundancy are shown in Tables 6 and 7. All Cronbach alpha and composite reliability scores exceed the recommended thresholds of 0.7 and 0.8 respectively (measures are internally consistent), and AVE scores exceed 0.5, indicating a satisfactory level of convergent validity. Shaded diagonals in Table 6, showing the square root of the respective AVE, are greater than off-diagonal correlation scores, indicating that measures also demonstrate satisfactory discriminant validity (Fornell & Larcker, 1981).

	1	2	3	4	5	6	7	8
1. Individual learning style	**0.82**							
2. Style emphasised in report	-0.09	**1.00**						
3. Learning style x Report style	-0.06	0.00	**0.82**					
4. Individual's motivational attitude	-0.07	0.19	0.07	**0.72**				
5. Outcome emphasised in report	-0.06	-0.02	-0.20	0.01	**1.00**			
6. Individual attitude x report outcome	-0.14	0.07	-0.24	0.01	0.07	**0.60**		
7. Perceived understanding of condition	0.21	-0.01	0.30	0.50	-0.03	-0.29	**0.84**	
8. Willingness to interact with physician	0.30	0.07	0.16	0.33	0.12	-0.32	0.60	**0.84**

Table 5 Latent variable correlations (square root of AVE shown in shaded diagonal)

Latent construct	R^2	ρ_c	Cronbach's α	AVE	Communality	Redundancy
Individual's learning style	-	0.89	0.85	0.68	0.68	-
Style emphasised in report	-	1.00	1.00	1.00	1.00	-
Individual's attitude	-	0.85	0.77	0.53	0.53	-
Attitiude emphasised in report	-	1.00	1.00	1.00	1.00	-
Perceived understanding	0.45	0.92	0.89	0.70	0.70	0.02
Willingness to interact	0.37	0.92	0.90	0.71	0.71	0.25

Table 6: Latent variable reliability and validity statistics (PLS)

Note that because the dataset contains only 60 observations, up to six indicators per latent variable could be included (Chin, 1998). Indicators with loadings of less than 0.5 were excluded on the basis that that the item may not have been interpreted as intended, and inclusion could therefore bias estimates. The bottom row of Table 7 is of particular interest with regard to the research questions. The r-squared statistic of 0.37 suggests that perceived understanding of the condition (after reading the prototype report) explains a large amount of variation in willingness to interact with the physician.

The results shown in Figure 4 indicate that the interactions between attitude and report format and information processing orientation (cognitive style) and report format jointly explain 41 per cent of the variance in perceived understanding. Perceived understanding, in turn explains 37 per cent of the variation in intentions to interaction with a physician.

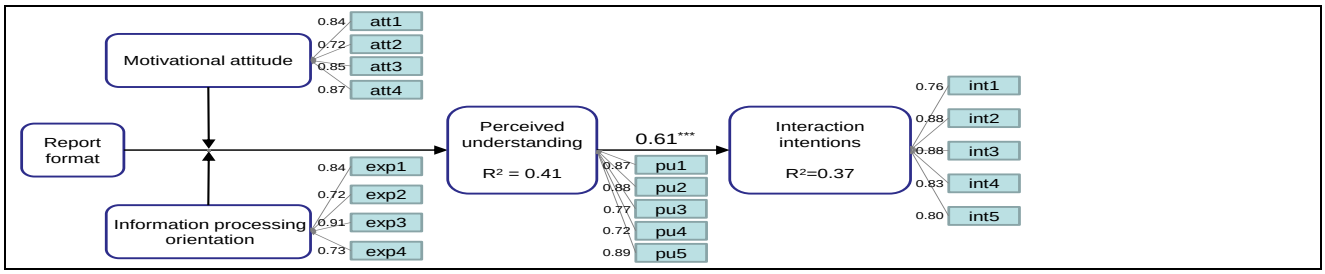

Figure 4: Path model results

In Table 7 we see that for the preferred information processing (cognitive) style interaction, people with a rational information processing style reported greater perceived understanding after viewing the rationally oriented report, and those with an experiential style reported greater perceived understanding after viewing the experiential report.

Based on latent variable scores for perceived understanding (which, unlike LISREL, can be extracted from PLS output) a mean score and 95% confidence intervals for understanding were computed for each participant. Because the measure of cognitive style is a continuous variable, high and low scores, representing the experiential and rational styles respectively, were calculated as mean ± one standard deviation as recommended by Jaccard and Turrisi (2003). These scores, shown in in Table below, indicate that reports that match the reader's cognitive style (top left and bottom right cells) are associated with the highest scores for perceived understanding (7.31 and 7.76), and that both of these scores are significantly higher than the score for the rational style-experiential report cell (5.97).

Cognitive style of reader	**Perceived understanding when reading rational report**	**Perceived understanding when reading experiential report**
rational style (mean – 1σ = 3.55)	7.31	5.97
95% confidence interval	6.83 to 7.79	5.49 to 6.45
experiential style (mean + 1σ = 5.67)	6.95	7.76
95% confidence interval	6.36 to 7.54	7.18 to 8.35

Table 7: Mean perceived understanding for information processing styles

Table 8, which shows mean scores for motivational style differences, is similar, with perceived understanding scores highest where the motivation of the reader matches the issues emphasised in the report, although the difference is only statistically significant comparing matches with the utilitarian attitude and value-expressive report mismatch.

Motivation of reader	**Perceived understanding when reading utilitarian report**	**Perceived understanding when reading value-expressive report**
Utilitarian (mean – 1σ = 3.93)	5.25	3.60
95% confidence interval	4.77 to 5.73	3.12 to 4.08
Value-expressive (mean + 1σ = 6.15)	5.18	5.67
95% confidence interval	4.64 to 5.72	5.13 to 6.21

Table 8: Mean perceived understanding for motivation

4 Discussion

The results show the benefit of matching an information display to a person's information processing style and attitude as supported by the previous literature (Novak & Hoffman 2008). We have shown this in a multi-step process by correlating thinking styles and perceived understanding and perceived understanding and willingness to interact. That is, if you provide patients with information that matches their personal cognitive style and attitudes, they are more likely to understand it and increase their interaction with their doctor. These effects are of theoretical and practical significance.

Future work involves taking this model and considering how we can use information systems to produce medical reports that match the patients' individual attitudes and information processing or cognitive style and whether these new report formats can encourage the level of engagement that previous literature suggests is required for adherence (Roy P. C. Kessels, 2003). Our aim is to produce individualised patient reports and to automate the delivery system so that a personalised report can be easily transferred from the pathology lab to the doctor's desktop in a patient friendly form. This work will need to consider whether this tool will be situated at the laboratory site, GP site or an independent location. It will need to examine how data is collected and structured to accommodate reports which use variations of the type described in Figure 4 and how a chosen approach can be implemented.

The research team has approached this problem through the delivery of pathology reports, but the potential applications are far greater. Pathology reports provide a relatively simple environment to explore the issues because they have traditionally been developed as an output of a lab not as a user-friendly document for either patient or doctor. However, the broader theory explored in this research could potentially apply to a range of medical reports. Our vision is that this consumer information theory could eventually be applied when doctors or educators explain patient-specific results from radiology, X-ray and other results as well.

5 Conclusion

Patient adherence with medical advice is a significant and continuing problem which impacts hugely on chronic disease rates and individual outcomes. Consequently health educators continue to grapple with the issue of how to present information to patients in ways that they are more likely to take notice and act.

The work reported in this paper is part of a multi-stage project that has earlier found that presenting information in a style that fits an individual patient leads to greater understanding of that information. Here we take this work one stage further to show that the way information is presented also impacts on the extent to which a patient is likely to interact with their medical provider. This finding is an important contribution given that earlier research suggests that interaction with one's doctor has a significant effect on whether a patient is likely to adhere to recommended treatment.

Currently, medical reports that doctors share with patients and carers are practitioner-focused. We envisage a scenario where a patient entering a doctor's surgery could complete a simple questionnaire to identify attitude and cognitive style. Using current software development techniques appropriately styled results, based on patient-centred measures, could be generated with minimal or no doctor overhead. When discussing results with the patient the doctor could use this data to ensure that the implications of results and the justification for adopting a recommended treatment are expressed in a style appropriate for that person.

These findings open up opportunities for the significant redesign and reapplication of the software that delivers medical results to provide patient-friendly results to improve communication between doctors and patients and ultimately improve patient outcomes.

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