PERFORMANCE EXPECTANCY, EFFORT EXPECTANCY AND SOCIAL INFLUENCE AS FACTORS PREDICTING THE ACCEPTANCE OF (NON-) FLUOROSCOPY-GUIDED POSITIONING FOR RADIOGRAPHS, AND THE RELATIONSHIP WITH LEADERSHIP

Aantal woorden: 8403

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Masterproef voorgelegd voor het behalen van de graad Master in de richting Management en Beleid van de Gezondheidszorg

Academiejaar: 2016 - 2017
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Abstract

Although using fluoroscopy to position the patient for radiographic examinations is unethical, it is commonly used by several radiology departments. In an attempt to reach a deeper understanding of the acceptance of non-fluoroscopy guided positioning, this study investigates the predictive value of performance expectancy, effort expectancy and social influence. Subsequently, the moderation of individualised consideration, as a leadership trait, is tested. The study is performed by using data of a self-administered paper and pencil questionnaire distributed among 17 Belgian hospitals. All 301 radiographers working in the radiology departments were invited to cooperate. Effort expectancy is found to be the strongest predictor, closely followed by performance expectancy. The effect of social influence is also found to be significant. The outcome of the moderation analysis shows that only the effect of social influence on the behavioural intention to use non-fluoroscopy-guided positioning is significantly moderated by individualised consideration. The significance of the results and the practical implications are discussed afterwards.
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Introduction

This paper is written with a twofold objective. The first one is to examine the use of non-fluoroscopy-guided positioning (non-FGP) within Belgian radiology departments. More specifically, this study aims to investigate the effect of performance expectancy, effort expectancy and social influence on the behavioural intention to use non-fluoroscopy-guided positioning. The second objective of this study is to explore if leadership moderates the effect of aforementioned possible predictors.

As a result of human failure, one introduced technologies and techniques to overcome mistakes and accidents caused by people (Aarts & Gorman, 2007). Before replacing them, several factors are to be taken into consideration. Besides reduced costs, quality and safety of care are important consequences to explore (Shekelle, Morton, & Keeler, 2006).

From this perspective, the question to use or not to use fluoroscopy for the patient’s positioning is subject of a substantial discussion. Fluoroscopy-guided positioning on the one hand is the practice of using fluoroscopy in order to determine the correct position of the patient’s anatomy before a radiographic examination (American Society of Radiologic Technologists, 2015). Although fluoroscopy-guided positioning is a violation of the ALARA principle and is seen by the American Society of Radiologic Technologists (ASRT) as unethical, it is commonly used by several institutions (Haynes & Curtis, 2009). FGP is believed to be a faster method compared to repeated radiation exposures thus benefiting from a lower radiation dose (Saunders, Budden, MacIver, Teunis, & Warren-Forward, 2005; Statkiewicz-Sherer, Visconti, Ritenour, & Haynes, 2014). Non-FGP on the other hand, relies on the radiographer’s skills and on the use of anatomic orientation points to precisely position the patient. The argument in favour of FGP becomes tenuous if held against current data: with repeat rates of barely 7% to 8%, 90% of all patients would be overexposed unnecessarily when using fluoroscopy (Statkiewicz-Sherer et al., 2014).

Information Technology in Healthcare Systems

Thanks to its healthcare system, known as Europe’s most generous one, Belgium climbed to the fourth place in the Euro Health Consumer Index (EHCI) with 860 points.
Belgium received maximum scores for ‘accessibility’, but concerning ‘outcomes’ and ‘prevention’ much room for improvement is left (Health Consumer Powerhouse, 2017).

The term ‘system’ can be defined as a set of interdependent factors, in the case of a healthcare system, people (Begun, Zimmerman, & Dooley, 2003). For years people have been seen as the main cause of accidents and mistakes. Technologies and techniques have therefore been developed (Aarts & Gorman, 2007). The implementation of information technology (IT) in medical settings is growing, although lying behind other industries. The slower pace in health care can be explained by the fact that return on investment before engaging in expensive projects is far more taken into consideration than in other industries. Insufficient resources force them to deliver accurate estimations on the financial consequences, quality improvements and efficiency gains (Calman, Kitson, & Hauser, 2007). Especially the following three factors must be taken into account when analyzing the usefulness of information technologies. To begin with, the positive results in terms of quality and safety should be considered, because the introduction of IT in medical settings is supposed to play a key part in gaining quality and improving safety. Besides these improvements focused on patients, new technologies will also help to reduce costs and create new opportunities (Ovretveit, Scott, Rundall, Shortell, & Brommels, 2007; Shekelle et al., 2006). Therefore, the cost-effectiveness of the implementation is of outmost importance. Finally, if a technology has proven its effect in one organisation others should be able to equally collect its benefits before engaging in a project (Shekelle et al., 2006).

In addition, there is the typical complex and dynamic environment of a healthcare organisation (Sittig & Singh, 2010). Complexity refers to the diversity of tasks, services, expertises and patients within the medical setting, whereas dynamic to the relatively high level of change in the environment (Everaert, Bruggeman, & Hoozée, 2013). A healthcare organization (e.g. hospital) is therefore considered a complex adaptive system (CAS): implying variation and adaptive, having the ability to adjust to changing circumstances. The whole set of interdependent agents that define the system are the people whose actions are based on previous knowledge and actual conditions (Begun et al., 2003). It is an ongoing challenge to design and to implement a technology or technique that can operate in such a system (Sittig & Singh, 2010).
Thanks to information technology, the number of patients harmed by medical mistakes can be reduced in three ways: by eliminating the errors, by reacting quicker if a mistake has occurred and by providing feedback afterwards (Bates & Gawande, 2003). However, the implementation of a new technology is not without any risks. Research showed a considerable failure rate when introducing a new technique or a new information system. In general, more than 40% of the IT implementations were unsuccessful, as projects did not meet deadlines and quality requirements criteria were over budget (Aarts & Gorman, 2007; Kaplan & Harris-Salamone, 2009). In 2007 McManus and Wood-Harper wanted to understand the sources of failure in the implementation of information systems. They collected information from 214 projects, including 18 healthcare projects. Results indicated that approximately 24% were cancelled due to management, business and technical reasons. More specifically, lack of management judgement (leadership), insufficient knowledge and poor communication with stakeholders. Others confirm that despite huge governmental investments, the adoption of the health information technology is unsuccessful. One of the most important obstacles is that physicians seem to have doubts about the performance of the technology (DesRoches et al., 2008).

The difficult adoption of newly introduced technologies and techniques can thus be explained by a lack of understanding. One has to gather information about how individuals and organisations handle these innovations (Aarts & Gorman, 2007; Kaplan & Harris-Salamone, 2009), because a successful implementation depends on their acceptance and use (Kijsanayotin, Pannarunothai, & Speedie, 2009). Therefore, staff training can be critical (Calman et al., 2007).

**Radiation**

Radiography is the technique of taking photographs with X-rays to view the internal structure of the body. By using small doses of ionizing radiation pictures can be produced for the diagnosis of fractured bones, injuries or infections (Verschakelen & Desmedt, 2012). X-rays for diagnostic examinations are responsible for about 14% of the total radiation exposure. Despite the existing risk of developing cancer, the use of
radiography is generally accepted because of its great benefits and the usually low doses of radiation (Berrington de González & Darby, 2004).

According to the ALARA -as low as reasonably achievable- radiation safety principles, the exposure to radiation should be as low as possible. The three basic principles to minimize the radiation doses and the release of radioactive particles are: time, distance and shielding. Reducing the time of exposure influences the amount of radiation immediately. Distance has a similar effect: maximizing the distance between the source and the patient will reduce the exposure as well. The third principle, shielding, refers to the lead protection used in radiation areas. Examples are lead aprons and lead glasses. These measures are needed to decrease the risk of developing cancer from radiation exposure (International Atomic Energy Agency, 2015). Choosing the right radiation dose is critical: finding the balance between a high image quality and an as low as possible exposure. A high dose holds more risks, too low a dose on the other hand, can result in a wrong diagnosis (American Society of Radiologic Technologists, 2015). Because of this dilemma, the use of fluoroscopy-guided positioning (FGP) is highly discouraged, as the total radiation dose needed is too high and is therefore to be avoided. A training program for the staff can lead to a decrease in the use of positioning with fluoroscopy (Dierckx, Constales, Gerardy, Goegebuer, & Persyn, 2006).

Due to the annually growing examinations via radiography and the increasing attention paid to the risk of radiation exposure, there is a growing interest in this topic in our society (Statkiewicz-Sherer et al., 2014).

**Conceptual Framework**

**The Unified Theory of Acceptance and Use of Technology (UTAUT).** The theoretical model used in this article is the Unified Theory of Acceptance and Use of Technology (UTAUT) of Venkatesh, Morris, Davis and Davis (2003). UTAUT integrates eight prominent models regarding individual acceptance of newly introduced information technologies. The first one is the Theory of Reasoned Action (TRA) formulated by Ajzen and Fishbein (1977) according to which behavioural intention is determined by the attitude towards behaviour and by the subjective norm in the close environment. The Technology Acceptance Model (TAM; Davis, 1986) is the second
model Venkatesh et al. (2003) explored. It aims to predict the acceptance and use of information technology, especially on the job. This model shows the influence of perceived usefulness and perceived ease of use on the behavioural intention to use a technology and on the attitude towards using it. The latter determines behavioural intention as well. Next, the Motivational Model (MM; Davis, Bagozzi, & Warshaw, 1992) explains how extrinsic and intrinsic motivation can be used to understand new technology acceptance and use. The fourth theory used is the Theory of Planned Behavior (TPB) by Ajzen (1985). By adding the construct of perceived behavioural control this theory is the extended version of the TRA. The next model is a hybrid model, namely the Combined TAM and TPB (C-TAM-TPB; Taylor & Todd, 1995). The predictors of the TPB are taken together with the construct of perceived usefulness from TAM. Thompson, Higgins and Howell (1991) identify in their Model of PC Utilization (MPCU) six core constructs affecting PC utilization: job-fit, complexity of the innovation, long-term consequences, affect towards use, social factors and facilitating conditions. Next, the Innovation Diffusion Theory (IDT; Rogers, 1995) consists of five elements of innovation that influence the acceptance behaviour of an individual: relative advantage, ease of use, image, visibility, compatibility, results demonstrability and voluntariness of use. The last theory adopted by Venkatesh et al. (2003) is the Social Cognitive Theory (SCT; Bandura, 1986). The SCT suggests a reciprocal influence of environmental factors, personal factors (self-efficacy, affect, anxiety etc.) and behaviour.

Based on those eight the UTAUT was formulated containing the most important constructs. The three determinants of the intention to use a new information technology are performance expectancy, effort expectancy and social influence. A fourth construct, facilitating conditions, is a direct determinant of the actual use, but cannot be used to predict behavioural intention. The first determinant, performance expectancy (PE) can be defined as “the degree to which the user expects that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). Research suggested that this is one of the most important predictors of the intention to use technology (Venkatesh et al., 2003; Kijsanayotin et al., 2009; Liu et al., 2014). The relationship between performance expectancy and behavioural intention was proven to be moderated by gender and age, meaning that the effect of the predictor is stronger for
younger people and men. Subsequently effort expectancy (EE) can be explained as the anticipated complexity of the technology and the degree of energy needed to use it. The effect of effort expectancy on behavioural intention was moderated by gender, age and experience. The effect was more significant for women, older people and less experienced workers (Venkatesh et al., 2003). Social influence (SI) refers to the belief of important others that the individual should accept the new system. The impact of this factor has the tendency to be more important among women, older people and lower levels of experience. In the context of non-voluntary use the impact of social influence is also bigger (Venkatesh et al., 2003). Finally, the facilitating conditions (FC) cover the extent to which an individual perceives that infrastructure can be used to apply the new technology. The expected moderation of age and experience was found. The effect of facilitating conditions on actual use was stronger for older workers and people with higher levels of experience (Venkatesh et al., 2003). This study focuses on the effect of performance expectancy, effort expectancy and social influence on the behavioural intention to use non-fluoroscopy-guided positioning. The direct effect of facilitating conditions on the actual use of non-FGP is not included, because this study aims a deeper understanding of the factors influencing behavioural intention (see Figure 1).

![Figure 1. Schematic view of the research model, based on the original UTAUT. Full lines are the effects tested in this study.](image-url)
**Performance expectancy.** As mentioned before performance expectancy (PE) can be defined as “the degree to which the user expects that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). More concrete this means that people are more likely to adopt new technologies when they believe this will help them to perform their job.

Venkatesh et al. (2003) integrated five concepts from various models into the construct of performance expectancy, namely perceived usefulness, extrinsic motivation, job-fit, relative advantage and outcome expectations. The concept of perceived usefulness was introduced by Davis (1986) in the Technology Acceptance Model and adapted by Taylor and Todd (1995) in their C-TAM-TPB. The definition of this concept is similar to the one of performance expectancy and refers to an individual’s perception about the likelihood that the use of a system will enhance his or her performance on the job (Davis, 1986; Taylor and Todd, 1995). When the encouragement to perform an activity is achieving external outcomes, the motivation to do this is called extrinsic. Examples of extrinsic motivation are rewards and punishments such as salary, grades or promotions (Davis et al., 1992). Job-fit as a third concept can again be explained by the believe of an individual that accepting the technique or technology will lead to gains in job performance (Thompson et al., 1991). The extent to which an individual perceives a new technology as being more useful than the previous one, simply explains the concept of relative advantage (Rogers, 1995). Bandura (1986) introduced outcome expectations in his Social Cognitive Theory. This concept is divided into performance-related (or job-related) and personal-related outcome expectations (e.g. sense of accomplishment and self-esteem). The similarities between these concepts are acknowledged by several researchers (Davis, Bagozzi, & Warshaw, 1989; Plouffe, Hulland, & Vandenbosch, 2001).

The relationship between performance expectancy and the intention to use or the actual use of new technologies in healthcare settings has been the subject of many research questions. In studies executed around the world the techniques or technologies are diverse, ranging from electronic medical records to robotic-assisted surgery (Arman & Hartati, 2015; BenMessaoud, Kharrazi, & MacDorman, 2011). All hypothesized that performance expectancy predicts the acceptance of IT in healthcare organizations and most of them found evidence for this assumption (Phichitchaisopa & Naenna, 2013;
Van der Vaart, Atema, & Evers, 2016). Although these results indicate a clear answer to the hypothesis, other researchers did not find a statistically significant effect of performance expectancy on behavioural intention or actual use (Schaper en Pervan, 2007; Vanneste, Vermeulen, & Declercq, 2013). Devolder, Pynoo, Sijnave, Voet and Duyck (2012) found that the UTAUT predictors had different weights dependent on the subgroup studied and thus suggest that every type of people should be treated separately.

**Effort expectancy.** The second concept, effort expectancy, can be defined as “the degree of ease associated with the use of the system” (Venkatesh et al., 2003, p.450). Similar to performance expectancy, Venkatesh et al. (2003) captured three constructs from other models into this concept, that is perceived ease of use, complexity and ease of use. The first one, perceived ease of use, is a concept from the Technology Acceptance Model (Davis, 1986) which refers to the idea of someone that using the new technology will be effortless. The second concept integrated in effort expectancy, is complexity of the MPCU (Thompson et al., 1991). Complexity in this model, to be understood as the difficulty to use a system, as perceived by the users. Ease of use as a last concept, is a core construct of the IDT (Rogers, 1995) and its definition is apart from one difference equal to the one of complexity. The definition of complexity concerns a general system whereas ease of use is about an innovation (Venkatesh et al., 2003). Among others, Plouffe et al. (2001) and Thompson et al. (1991) confirmed the similarities between these concepts.

The hypothesis that effort expectancy positively affects the behavioural intention to use, as well as the actual use of a technique or a technology, has regularly been formulated in previous studies (Arman & Hartati, 2015; Chang, Hwang, Hung, & Li, 2007; Phichitchaisopa & Naenna, 2013). Most researchers found support for this relationship (Chang et al. 2007; Phichitchaisopa & Naenna, 2013), but others concluded that effort expectancy had no significant influence (Arman & Hartati, 2015; Bennani & Oumllil, 2013). Arman and Hartati (2015) argue that the characteristic of the sample could have been the possible explanation. Almost 70% of the participants had a maximum age of 50 years and 67% were specialists with a lot of experience, and as
previously mentioned age and experience both moderate the effect of effort expectancy (Arman & Hartati, 2015; Venkatesh et al., 2003).

Social influence. According to the UTAUT social influence of “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al., 2003, p.451) is the third and last direct determinant of the behavioural intention to use a technique or technology (Venkatesh et al., 2003). The three concepts included in social influence are: subjective norm, social factors and image. Each of these concepts refer to the notion that the social environment has a substantial influence on the way people act (Venkatesh et al., 2003). Subjective norm was introduced in the TRA by Ajzen and Fishbein (1977), then used by Ajzen (1985) in his TPB and by Taylor and Todd (1995) in their C-TAM-TPB. Venkatesh and Davis (2000) extended the Technology Acceptance Model by including subjective norm as an extra concept for the prediction of behavioural intention. Their new model was called TAM2. The concept can be explained by one’s perception about how important others think he or she should act. Social factors as a second concept integrated in social influence refers to the internalisation of the culture and social agreements the individual shares with others (Venkatesh et al., 2003). Social factors is a core construct of the Model of PC Utilization by Thompson et al. (1991). The third concept, image, is introduced in the IDT by Rogers (1995) and can be understood as the perception that the use of a new technique or technology will upgrade a person’s image or social status.

Based on the UTAUT, researchers often want to investigate the hypothesis that social influence has a positive effect on the behavioural intention to use, and the actual use of a technique or technology (Arman & Hartati, 2015; Chang et al., 2007; Phichitchaisopa & Naenna, 2013). Although some researchers found social influence was the most salient predictor (Alaiad & Zhou, 2014), others found that the effect was only marginally significant (Chang et al., 2007). Indeed, some studies even had to reject the hypothesis, because the effect of social influence did not achieve significance (Bennani & Oumlil, 2013; Phichitchaisopa & Naenna, 2013). A possible explanation for the absent effect is the timing of the study. Social influence cannot be significant if changes are just instituted. The personality of the participants is another probable
explanation. Individuals who are more self-confident and experienced are less influential by social pressure (Chang et al., 2007; Phichitchaisopa & Naenna, 2013).

**Behavioural intention and use.** The two outcome variables in the UTAUT are behavioural intention and the actual use or behaviour. Behavioural intention refers to a desire or a purpose and is a direct determinant of the actual use. Whereas the intention to use a system can change over time, the behaviour is the actual form of usage (Arman & Hartati, 2015). Ajzen & Fishbein (1977) argue in their TRA that beliefs influence attitudes, and those in turn create intentions. The relationship between both constructs is found to be conclusive in the context of healthcare (Chau & Hu, 2001; Davis et al., 1989; Venkatesh et al., 2003).

**Leadership**

In 2003 McManus and Wood-Harper conducted a study about information technology in order to understand the causes of project failure. In 65% of the unsuccessful IT projects, management factors were the most important reasons for failing: more specifically, poor leadership in project delivery, poor management communication and insufficient management support. In their second research, management causes accounted for 53% of the project cancelations. Lack of delegation and decisions making, poor judgement and again poor communication were some of the key reasons (McManus & Wood-Harper, 2007). The study of Eom, Choi and Sung (2016) ended with the same conclusion: a lack of communication is associated with negative effects. Chang and Hsu (2012) added that management support was a crucial determinant of the intention to use a new technology.

In this research, previous findings were brought together with individualised consideration. The concept is a subscale of the transformational leadership style included in the Multifactor Leadership Questionnaire (MLQ) by Avolio and Bass (2004). Individualised consideration can be understood as the characteristic of leaders who pay attention to the individual needs of the subordinates and coach them through obstacles and difficult situations (Avolio & Bass, 2004; Gabel, 2012). Those leaders also reinforce the followers’ strengths and self-efficacy within a supportive climate (Avolio & Bass, 1998).
Based on previous literature this study hypothesizes a moderation of individualised consideration on the effects of the three predictors on behavioural intention (see Figure 2).

![Diagram showing the moderation effects tested in this study.](image)

**Figure 2.** Schematic view of the moderation effects tested in this study.

**The Current Study**

The aim of this study is to gain knowledge of the acceptance of non-fluoroscopy-guided positioning in Belgian radiology departments. The departments participating in it are spread over 15 Belgian hospitals, more particularly Flemish hospitals. The data used to conduct this study were gathered by another researcher, Sofie Germonpré. The effect of performance expectancy, effort expectancy and social influence on the behavioural intention to use non-FGP will be explored. Furthermore, the possible influence of individualised consideration on these effects will be examined.

Based on previous literature research the following hypotheses were formulated:

**H1:** Performance expectancy is expected to have a positive effect on the behavioural intention to use non-fluoroscopy-guided positioning.
H2: Effort expectancy is expected to have a positive effect on the behavioural intention to use non-fluoroscopy-guided positioning.

H3: Social influence is expected to have a positive effect on the behavioural intention to use non-fluoroscopy-guided positioning.

H4: The behavioural intention to use non-fluoroscopy-guided positioning is expected to have a positive effect on the actual use of the technique.

H5: The effect of performance expectancy on the behavioural intention to use non-fluoroscopy-guided positioning is expected to be moderated by individualised consideration.

H6: The effect of effort expectancy on the behavioural intention to use non-fluoroscopy-guided positioning is expected to be moderated by individualised consideration.

H7: The effect of social influence on the behavioural intention to use non-fluoroscopy-guided positioning is expected to be moderated by individualised consideration.

Method

Sample and Procedure

The data used in this study are collected by another researcher, Sofie Germonpré. Approval by the Ethics Committee of Ghent University Hospital was obtained (Belgian registration number: B670201524225). For anonymity reasons, all the information that could identify the subjects was removed. Out of 17 randomly addressed hospitals in the Flemish part of Belgium, 15 agreed to cooperate. Paper and pencil questionnaires were distributed among 301 radiographers in 2015. This study focuses on the following six concepts from the questionnaire: performance expectancy, effort expectancy, social influence, behavioural intention, actual use and individualised consideration.
The questionnaire consisted of 26 items meant to collect information about demographic or personal variables and the research variables: performance expectancy, effort expectancy, social influence, behavioural intention, actual use of non-FGP and individualised consideration. The questionnaire was divided into two sections. The first section contained questions about demographic variables and other personal information. Date of birth and diploma were asked, both were open-ended questions. For the other questions the subjects had to fill in their sex (0 = male or 1 = female), years of employment (1 = <1 year, 2 = 1-5 years, 3 = 5-10 years, 4 = 11-20 years or 5 = >20 years), time working at the radiology department (1 = <50%, 2 = 50-75%, 3 = >75% or 4 = 100%), time working in radiography (1 = <50%, 2 = 50-75%, 3 = >75% or 4 = 100%) and they had to answer if they had followed an external training (0 = no or 1 = yes).

The second section contained questions about the constructs included in the research. Performance expectancy was measured by a seven-point Likert scale, ranging from 1 totally disagree to 7 totally agree. The three items of this concept were ‘I think fluoroscopy is useful in my job’, ‘Using fluoroscopy enables me to work more quickly’ and ‘Using fluoroscopy increases my productivity’. The four items representing effort expectancy were: ‘The techniques of non-FGP are easy to understand’, ‘I master the techniques of non-FGP well’, ‘I think non-FGP is simple’ and ‘I think acquiring the techniques of non-FGP is simple’. Participants scored their level of agreement using a seven-point Likert scale, ranging from 1 totally disagree to 7 totally agree. The last predictor ‘social influence’ was represented by the four following items: ‘My colleagues think I should always use non-FGP’, ‘The radiologists think I should always use non-FGP’, ‘My direct supervisor supports me in the use of non-FGP’ and ‘In general, the department supports the use of non-FGP’. The items were assessed on a seven-point Likert scale, ranging from 1 totally disagree to 7 totally agree. The following three items represented the concept of the behavioural intention to use non-FGP: ‘I have the intention to use non-FGP for all radiographs in the next months’, ‘I am planning to use non-FGP for all radiographs in the next months’ and ‘I predict I will use non-FGP for all radiographs in the next months’. Again a seven-point Likert scale, ranging from 1
totally disagree to 7 totally agree was used. One item concerning the actual use of non-FGP (‘To what extent did you use non-FGP during the last few months?’) was assessed on a seven-point Likert scale, ranging from 1 never to 7 always. The items of all concepts of the UTAUT were based on the original questionnaire of Venkatesh et al. (2003). The leadership concept in this study was approached from a particular leadership trait, being individualised consideration (Avolio & Bass, 2004). The four items included in the questionnaire were: ‘My direct supervisor pays attention to each one individually’, ‘My direct supervisor confirms my strengths’, ‘My direct supervisor helps me to develop my competences’ and ‘My direct supervisor makes a distinction between his employees’. Subjects scored their level of agreement using a five-point Likert scale, ranging from 1 totally absent to 5 most of the time or even always present. The higher the score, the more a subject perceives his or her direct supervisor as high on individualised consideration.

Statistical Analyses

To analyse the demographics of the sample, the concepts captured in this research and the relationships between them, SPSS statistics version 24 was used. First of all, for each construct the reliability of the different scales was evaluated (Cronbach’s Alpha). Secondly, descriptive statistics were used to summarize all demographic variables and research variables. Thereafter, a simple regression analysis was performed to measure the effects of the three predictors on the behavioural intention to use non-fluoroscopy-guided positioning. As a last step the moderation hypotheses were assessed by doing a linear regression.

Results

Reliability Analysis

The Cronbach’s Alphas of the five constructs are displayed in Table 1. All Alphas are above the threshold of .70 (Nunnally, 1978), meaning that the reliability is confirmed. One item of the construct individualised consideration had to be recoded before the analysis, because it was negatively phrased.
Table 1

Results of the reliability analysis (Cronbach’s Alpha)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance expectancy</td>
<td>.84</td>
<td>3</td>
</tr>
<tr>
<td>Effort expectancy</td>
<td>.86</td>
<td>4</td>
</tr>
<tr>
<td>Social influence</td>
<td>.80</td>
<td>4</td>
</tr>
<tr>
<td>Behavioural intention</td>
<td>.94</td>
<td>3</td>
</tr>
<tr>
<td>Individualised consideration</td>
<td>.80</td>
<td>4</td>
</tr>
</tbody>
</table>

Descriptive Research

Demographic variables. A total of 177 subjects completed the questionnaire, a response rate of 58.8%, ranging from 30% to 100% in the individual hospitals. The average age of the participants was 37.81 years (SD = 11.27). The age of the sample ranged from 22 years to 62 years, but there were 16 missing values. More than half of the respondents were women (64.4%) and 63 men (35.6%) participated in this study. Seventy-five employees (42.4%) had a bachelor of science in nursing, 59 were nursing assistants (33.3%), 37 participants were technologists in medical imaging (20.9%) and six had a different diploma or did not fill in the question (3.4%). The length of employment ranged from less than one year to more than 20 years. Twelve subjects worked less than one year at the radiology department (6.8%), 36 between one and five years (20.3%), the majority between five and ten years (35.6%), 27 participants worked there between 11 and 20 years (15.3%) and 36 subjects had a length of employment of more than 20 years (20.3%). Three subjects forgot to answer this question. Concerning the time of working at the radiology department, 116 participants (65.5%) had a fulltime job, 41 employees worked more than 75% (23.2%), 17 participants worked between 50% and 75% (9.6%) and three participants worked less than halftime (1.7%). Regarding the time of working in radiography the same answer options were given. Sixty subjects (33.9%) had a fulltime job, 43 worked more than 75% (24.3%), 43 between 50% and 75% (24.3%) and 31 participants worked less than 50% (17.5%).
last variable of the first section gives information about whether or not the subject followed an external training. The majority, 115 participants (65%), did not attend such training. One person did not answer this question, meaning that 61 subjects (34.5%) completed an external programme.

**Research variables.** The use of non-FGP was measured by one item. The majority of the participants answered that they regularly (28.2%) or frequently (27.7%) used non-FGP to do radiographic examinations. Other possibilities are summarized in Table 2.

In order to comprehensibly summarize the scores of the three predictors and behavioural intention, three groups are introduced. Group 1 contains all participants with a score between one and 3.49. In Group 2 all scores rounded up to four are included. Group 3 contains scores between 4.5 and seven. For the concept of individualised consideration again three groups are introduced. A similar classification was applied. In Group 1 all participants with a general score between one and 2.49 are included. Group 2 contains all scores rounded up to three and Group 3 includes all scores between 3.5 and five.

Performance expectancy was assessed by three items about the participants’ perception of fluoroscopy-guided positioning and its utility. The scores were summed up and divided by three to end up with a general score for the concept of performance expectancy. The scores ranged from one to seven, with a mean of 4.67 (SD = 1.32). Group 1 contained general scores of 29 participants, Group 2 of 39 and 104 subjects had a score situated in Group 3.

Effort expectancy was represented by four items on a seven-point Likert scale. The scores were averaged to reach a general score. Those ranged from one to seven, with a mean of 4.58 (SD = 1.04). Likewise the concept of performance expectancy similar groups were made. Twenty-one subjects had a average score situated in Group 1. Fifty-five participants were situated in the neutral group, Group 2. Group 3 contained scores of 88 participants.

The assessment of social influence was based on four items about the perceived social pressure to use non-FGP. The average scores ranged from one to seven with a mean of 3.57 (SD = 1.11). Group 1 contained general scores of 61 participants, Group 2
Table 2

Summary of all research variables

<table>
<thead>
<tr>
<th>Scale options</th>
<th>Frequencies (percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of non-FGP</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>4 (2.3)</td>
</tr>
<tr>
<td>Sporadically</td>
<td>9 (5.1)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>18 (10.2)</td>
</tr>
<tr>
<td>Regularly</td>
<td>50 (28.2)</td>
</tr>
<tr>
<td>Frequently</td>
<td>49 (27.7)</td>
</tr>
<tr>
<td>Mostly</td>
<td>42 (23.7)</td>
</tr>
<tr>
<td>Always</td>
<td>5 (2.8)</td>
</tr>
<tr>
<td>Performance expectancy</td>
<td></td>
</tr>
<tr>
<td>G1: Totally disagree to disagree</td>
<td>29 (16.4)</td>
</tr>
<tr>
<td>G2: Neutral</td>
<td>39 (22.0)</td>
</tr>
<tr>
<td>G3: Agree to totally agree</td>
<td>104 (58.8)</td>
</tr>
<tr>
<td>Missing</td>
<td>5 (2.8)</td>
</tr>
<tr>
<td>Effort expectancy</td>
<td></td>
</tr>
<tr>
<td>G1: Totally disagree to disagree</td>
<td>21 (11.9)</td>
</tr>
<tr>
<td>G2: Neutral</td>
<td>55 (31.1)</td>
</tr>
<tr>
<td>G3: Agree to totally agree</td>
<td>88 (49.7)</td>
</tr>
<tr>
<td>Missing</td>
<td>13 (7.3)</td>
</tr>
<tr>
<td>Social influence</td>
<td></td>
</tr>
<tr>
<td>G1: Totally disagree to disagree</td>
<td>61 (34.5)</td>
</tr>
<tr>
<td>G2: Neutral</td>
<td>73 (41.2)</td>
</tr>
<tr>
<td>G3: Agree to totally agree</td>
<td>33 (18.6)</td>
</tr>
<tr>
<td>Missing</td>
<td>10 (5.6)</td>
</tr>
<tr>
<td>Behavioural intention</td>
<td></td>
</tr>
<tr>
<td>G1: Totally disagree to disagree</td>
<td>87 (49.2)</td>
</tr>
<tr>
<td>G2: Neutral</td>
<td>52 (29.4)</td>
</tr>
<tr>
<td>G3: Agree to totally agree</td>
<td>31 (17.5)</td>
</tr>
<tr>
<td>Missing</td>
<td>7 (4.0)</td>
</tr>
<tr>
<td>Individualised consideration</td>
<td></td>
</tr>
<tr>
<td>G1: Totally absent to rarely</td>
<td>30 (16.9)</td>
</tr>
<tr>
<td>G2: Sometimes</td>
<td>57 (32.2)</td>
</tr>
<tr>
<td>G3: Frequently to always</td>
<td>77 (43.5)</td>
</tr>
<tr>
<td>Missing</td>
<td>13 (7.3)</td>
</tr>
</tbody>
</table>
of 73 and 33 subjects had a score situated in Group 3.

Behavioural intention was the next concept examined in this study. For each participant the average of the scores on the three items was used as a general score for the concept. The scores ranged from one to seven, with a mean of 3.50 (SD = 1.43). Eighty-seven participants had a general score situated in Group 1. Group 2 contained scores of 52 subjects and 31 subjects were situated in the last group (G3).

The concept of individualised consideration was measured by four items on a five-point Likert scale. The average scores ranged from one to five, with a mean of 3.26 (SD = .94). Group 1 contained scores of thirty participants. Fifty-seven subjects had an average score situated in Group 2 and 77 subjects gave scores situated in Group 3.

All frequencies and percentages of the concepts are summarized in Table 2.

**Regression Analysis**

In order to test the first three hypotheses (H1, H2 and H3) a linear regression was conducted. Based on previous literature (Venkatesh et al., 2003) the variables sex and years of employment are proven to moderate the effect of the independent variables on behavioural intention. Therefore, their effect is neutralized by entering them in the regression as control variables. Table 3 presents the results of the regression analysis with behavioural intention as dependent variable. Performance expectancy (t = -4.10, p < .01) as well as effort expectancy (t = 4.65, p < .01) have a significant effect on behavioural intention. The influence of social influence is marginally significant (t = 1.94, p < .10).

To test the effect of behavioural intention on actual use, a linear regression was conducted. Based on research of Venkatesh et al. (2003) there is no need to control for sex and years of employment. The effect is statistically significant (b = .31, t = 4.64, p < .01), thus confirming the fourth hypothesis (H4).

**Moderation Analysis**

In order to investigate if there is an influence of leadership (individualised consideration) on the effect of the three determinants (PE, EE and SI) on behavioural intention, a moderation analysis was performed. In a first step the three independent
Table 3

Results of the regression analysis with behavioural intention (BI) as dependent variable

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>SE B</th>
<th>B</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.86</td>
<td>.75</td>
<td>2.50</td>
<td>.01*</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>.24</td>
<td>.20</td>
<td>.08</td>
<td>1.16</td>
<td>.25</td>
</tr>
<tr>
<td>Years of employment</td>
<td>.03</td>
<td>.08</td>
<td>.03</td>
<td>.37</td>
<td>.71</td>
</tr>
<tr>
<td>PE</td>
<td>-.29</td>
<td>.07</td>
<td>-.29</td>
<td>-4.10</td>
<td>.00**</td>
</tr>
<tr>
<td>EE</td>
<td>.45</td>
<td>.10</td>
<td>.35</td>
<td>4.65</td>
<td>.00**</td>
</tr>
<tr>
<td>SI</td>
<td>.17</td>
<td>.09</td>
<td>.14</td>
<td>1.94</td>
<td>.05*</td>
</tr>
</tbody>
</table>

*= p < .10, ** = p < .01

variables and individualised consideration were centralized, so that the mean of all variables had a value of zero. In a second step, the interaction terms were created by multiplying the three new centralized independent variables with the centralized variable of individualised consideration. The third and last step included the regression analysis. Results are displayed in Table 4. The four main variables had a significant effect. Performance expectancy ($t = -3.41, p < .01$) and individualised consideration ($t = -1.90, p < .10$) had a significant negative effect whereas effort expectancy ($t = 3.70, p < .01$) and social influence ($t = 3.02, p < .01$) had a significant positive effect. The interaction effects of performance expectancy and individualised consideration ($t = .93, p > .10$), and effort expectancy and individualised consideration ($t = -1.13, p > .10$) were of no significance. The interaction effect of social influence and individualised consideration was marginally significant ($t = 1.83, p < .10$).

Discussion

The paper’s first aim is to examine three predictors of the acceptance of non-fluoroscopy-guided positioning for radiographs in Belgian radiology departments. The three predictors investigated, are performance expectancy, effort expectancy and social influence. As mentioned in a research by Devolder et al. (2012), the significant predictors differ between subgroups. This result justifies the interest of the current study.
Table 4

Results of the moderation analysis

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>SE B</th>
<th>B</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>3.31</td>
<td>.32</td>
<td>10.20</td>
<td>.00**</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>.16</td>
<td>.21</td>
<td>.06</td>
<td>.75</td>
<td>.45</td>
</tr>
<tr>
<td>Years of employment</td>
<td>-.01</td>
<td>.08</td>
<td>-.01</td>
<td>-.07</td>
<td>.95</td>
</tr>
<tr>
<td>PE_C</td>
<td>-.25</td>
<td>.07</td>
<td>-.25</td>
<td>-3.41</td>
<td>.00**</td>
</tr>
<tr>
<td>EE_C</td>
<td>.39</td>
<td>.10</td>
<td>.29</td>
<td>3.70</td>
<td>.00**</td>
</tr>
<tr>
<td>SI_C</td>
<td>.29</td>
<td>.10</td>
<td>.24</td>
<td>3.02</td>
<td>.00**</td>
</tr>
<tr>
<td>IC_C</td>
<td>-.21</td>
<td>.11</td>
<td>-.14</td>
<td>-1.90</td>
<td>.06*</td>
</tr>
<tr>
<td>PE_C*IC_C</td>
<td>.07</td>
<td>.07</td>
<td>.07</td>
<td>.93</td>
<td>.36</td>
</tr>
<tr>
<td>EE_C*IC_C</td>
<td>-.11</td>
<td>.10</td>
<td>-.09</td>
<td>-1.13</td>
<td>.26</td>
</tr>
<tr>
<td>SI_C*IC_C</td>
<td>.16</td>
<td>.09</td>
<td>.14</td>
<td>1.83</td>
<td>.07*</td>
</tr>
</tbody>
</table>

* = p < .10, ** = p < .01

to reveal the valuable predictors for this specific sample. As a second aim, this study
wants to explore the influence of leadership on the effect of those three concepts on the
behavioural intention to use non-fluoroscopy-guided positioning.

The data collected by Sofie Germonpré are used to answer the research
questions. She drew up a questionnaire including several concepts, among which
performance expectancy, effort expectancy, social influence, behavioural intention,
actual use and individualised consideration.

Research Results

In the analysis of this research the following four sections can be distinguished:
the reliability analysis, a descriptive research, a regression analysis and a moderation
analysis.

Reliability analysis. First of all, the reliability of the different constructs was
evaluated. All Cronbach’s Alphas did reach the desirable level of reliability, which
means the scales could be used. The reliability of the constructs based on the Unified
Theory of Acceptance and Use of Technology corresponded with those reported in the initial study by Venkatesh et al. (2003), although slightly lower. This difference can possibly be explained by the fact that all items were translated to Dutch and were adapted to the context of radiography.

**Descriptive research.** From the 301 distributed questionnaires, approximately 60% were returned. The average age of the participants at that time was a few months less than 38 years, ranging from 22 to 62 years. With 64%, the majority of the participants were women. For 97% the highest medical degree was a bachelor in nursing or medical imaging. No master degrees were present. The next variable relates to this. Years of employment in radiography equals years of experience, which is seen as a moderator of the effect of effort expectancy and social influence on behavioural intention (Venkatesh et al., 2003). In the sample of this study, almost three fourth of the participants had five or more years of relevant experience. Although 66% of the participants worked fulltime at the radiology department, only 34% of all participants worked fulltime in radiography. Since acquiring positioning skills is found to be the result of long and intensive practice (Germonpré et al., 2016), all those employees who worked only part-time in radiography cannot totally be blamed for not using such a difficult technique. As a last variable, participants were asked if they attended an external training. Only a minority of 35% completed an external programme. Previous research suggested that higher educated subjects might differ from others, in that they comprehend a complex technique more quickly and are less influenced by subjective norms (Chang et al., 2007; Chau & Hu, 2001). Moreover, Dierckx et al. (2006) concluded that, in Belgium, the decision to position the patient with or without fluoroscopy is determined by the staff’s training.

Use of non-fluoroscopy guided positioning as an outcome variable, was measured by one item on a seven-point Likert scale. The answers of the participants were rather negative because only half of the participants frequently to always used their skills and anatomic landmarks to position the patient. Although the risk of causing cancer is proven and fluoroscopic-guided positioning is seen as unethical (Berrington de González & Darby, 2004; International Atomic Energy Agency, 2015), still half of the sample failed to use non-FGP.
The second outcome variable is the behavioural intention to position a patient without fluoroscopy. The participants were asked if they intended to use non-FGP for all radiographs in the next months. Almost 30% was not sure about what they would do and nearly half admitted that they did not intend to use their skills and anatomic landmarks only to position the patient. Earlier we found that only 35% completed an external training. Insufficient knowledge and skills could be one possible explanation for not using anatomic landmarks to position the patient. Another likely explanation can be found in the non-monitoring of the radiology’s department head or the radiologist, especially in institutions where fluoroscopy is allowed to position the patient. In order to acquire adequate positioning skills the staff should be supervised and fluoroscopy time should be measured (Germonpré et al., 2016).

The first predictor of the behavioural intention to position the patient without fluoroscopy is performance expectancy. Contrary to the other concepts, the items that represent performance expectancy are formulated in favour of fluoroscopy-guided positioning. The majority of the respondents (59%) agreed on the fact that the use of fluoroscopy entails a rise in job performance. This is a remarkable fact given the negative recommendations in the literature (Berrington de González & Darby, 2004; International Atomic Energy Agency, 2015). It is possible that the participants answered these items without considering the negative consequences of fluoroscopy-guided positioning.

Concerning effort expectancy, the participants seemed to be considering the technique of non-FGP as rather simple. Only 12% of the sample had a score within Group 1, which means they did not master the technique or they thought that acquiring it was hard. These results are in contrast with the scores on the item concerning the actual use of non-fluoroscopy guided positioning. Although only a few people seemed to think that the technique is hard, still half of the participants did not position the patients without the use of fluoroscopy.

The results of social influence are less explicit, since more than 40% indicated that they had a neutral opinion about the social pressure and support they felt to use non-FGP. In several institutions, monitoring or support by the radiologists or the head of the department is rare (Germonpré et al., 2016). Therefore, it is possible that the staff in those institutions do not feel social pressure to use non-FGP. A second probable
explanation is the fact that the use of non-FGP is not obligatory in most hospitals (Germonpré et al., 2016), as the impact of social influence is found to be bigger in the context of non-voluntary use (Venkatesh et al., 2003).

Individualised consideration as a leadership trait is the last construct investigated. Three fourth of the participants perceived their direct supervisor as at least sometimes paying individual attention or helping with the development of strengths and competences. More than 40% even gave their supervisor a high score.

**Regression analysis.** Based on previous literature (Arman & Hartati, 2015; Phichitchaisopa & Naenna, 2013; Venkatesh et al., 2003) the first four hypotheses were formulated. As predicted, performance expectancy, effort expectancy and social influence all significantly affect the behavioural intention to use non-fluoroscopy guided positioning. The fourth hypothesis that behavioural intention had a significant effect on the actual use, was confirmed as well.

In contrast with earlier studies (Kijsanayotin et al., 2009; Liu et al., 2014; Venkatesh et al., 2003), effort expectancy was found to be the strongest predictor of behavioural intention, although closely followed by performance expectancy. The fact that both constructs are found to be important predictors is consistent with prior findings (Chang et al., 2007; Phichitchaisopa & Naenna, 2013). It is important to keep in mind that the items representing performance expectancy were formulated in favour of fluoroscopy-guided positioning. Results could have been different if the items would have estimated participants’ level of agreement on statements about the usefulness of non-FGP to do radiographic examinations.

The third predictor, social influence, also seemed to have a direct effect on behavioural intention, but the effect was only marginally significant. Based on previous literature, this is not a surprising finding. Among others, Chang et al. (2007) and Kijsanayotin et al. (2009) found a weaker, but still significant effect of social influence on the behavioural intention to use a technology or technique.

**Moderation analysis.** As a last step, a moderation analysis was performed. The effects of the three predictors were hypothesised to be moderated by individualised
consideration. Only the hypothesis that individualised consideration moderates the effect of social influence on behavioural intention was confirmed by the results.

As expected the effect of social influence was strengthened or weakened dependent on how high one’s direct supervisor scores on individualised consideration according to the individual’s perception. The results indicated that a subject who perceives his or her direct supervisor as giving frequently individual attention and support, will be more influenced by the opinion of important others. Given that leadership involves power and social influence (Gabel, 2012), a possible explanation is evident. Subjects who perceive their supervisor as more involved, will possibly experience more social pressure.

The effects of performance expectancy and effort expectancy are not moderated by the leadership trait, individualised consideration. These results are contradictory to the hypotheses. Leaders who make time for coaching moments and pay attention to individual needs, were expected to teach and reinforce their followers (Avolio & Bass, 1998). This study shows that the participants’ perception of their supervisor did not change the effect of performance expectancy and effort expectancy. In other words, their perception about the usefulness and the ease of use associated with positioning patients based on skills only was not influenced by how individually involved they perceived their supervisor.

**Strengths, Limitations and Practical Implications**

The first strength of this research is the selection of the sample. The 17 at random invited hospitals are located in the Flemish part of Belgium. Of those, 15 hospitals agreed to take part in this study. A randomly chosen sample, is representative for the population. Therefore, the results of this study can be generalised to other Flemish hospitals. The response rate, is the second strength of the study. Almost 60% of the distributed questionnaires, were returned. According to Baruch and Holtom (2008), this percentage is acceptable to generalise the results.

The first limitation of this study was the formulation of some items in the questionnaire. Problems arose to interpret the effect of performance expectancy. For a better understanding or a possible other result, the items representing performance
expectancy should be formulated in favour of non-fluoroscopy-guided positioning. A second limitation was the impossibility to draw causal conclusions due to the cross-sectional design of this study. In order to identify causal relationships, a longitudinal research or a follow-up study is necessary. Social desirability can be seen as a third potential limitation of this paper. The actual use of non-fluoroscopy-guided positioning was measured by only one item of a self-reported questionnaire. To avoid people from choosing the most desirable option on a statement, other methods should be used to measure behaviour (e.g. observations or log file analysis).

This study has several practical implications. Since previous studies found that training of the staff is critical in adopting a new system (Calman et al., 2007), and more specifically determines if fluoroscopy is used to position the patient (Dierckx et al., 2006), results of this study are remarkable. Approximately two thirds of the participants did not attend an external training. Based on previously mentioned studies and this finding, hospitals should possibly invest in extra programmes for its staff. A second implication of this study is a managerial tool at the same time. Since effort expectancy, performance expectancy as well as social influence are found to be significant predictors for the behavioural intention to use anatomic orientation points to position the patient, these insights can be used by managers or in this case by the head of the radiology department.

Conclusion

The results of this study indicate a relatively low use of non-fluoroscopy-guided positioning in Belgian radiology departments. Although staff training is critical to position the patient without fluoroscopy, results indicate a low percentage of participants completing an external programme. This is an important practical implication of this study. Subsequently, the first research question is examined. Effort expectancy is found to be the strongest predictor of the behavioural intention to position the patient without fluoroscopy, closely followed by performance expectancy. The third predictor, social influence, also significantly affects the intention to use non-FGP. Those findings can be a helpful tool for managers to stimulate the staff to position patients for radiographic examinations only by using their skills and anatomic
orientation points. The second aim of the study was to examine if leadership moderates the effect of the three predictors on behavioural intention. Results show a marginally significant moderation effect of individualised consideration on the effect of social influence on behavioural intention. The findings of this research are considered to provide important guidelines for making future decisions in the Belgian radiology departments.
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