Scandinavian Journal of Pain 9 (2015) 1–10

Contents lists available at ScienceDirect

Scandinavian Journal of Pain

journal homepage: www.ScandinavianJournalPain.com

Original experimental

Action identification and meaning in life in chronic pain

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HIGHLIGHTS

- We developed a novel measure to assess action identification in chronic pain.
- The measure has high content validity and satisfactory reliability.
- Action identification is positively related meaning in life and optimism.
- Interference and action identification contribute independently to meaning in life.

ARTICLE INFO

Article history:
Received 16 February 2015
Received in revised form 14 April 2015
Accepted 17 April 2015
Available online 6 June 2015

Keywords:
Action identification
Meaning in life
Chronic pain
Interference
Self-regulation

ABSTRACT

Background and aims: We explore the relationship between behaviour and cognition in chronic pain by applying Action Identification Theory (AIT). AIT holds that every action may be construed in several ways. High level construals confer greater meaning than lower level construals. When an action is interrupted a lower level, more concrete identity with reduced meaning is elicited. We hypothesized that interference of activity by chronic pain affects the meaning ascribed to activity and thus a person's overall sense of meaning in life.

Methods: In Study 1, a measure of Action Identification in Pain (AIP) is developed. In Study 2, the AIP was administered to 47 chronic pain patients who also completed the Meaningful Life Measure and measures of pain interference, depression, acceptance and optimism.

Results: High levels of action identification were positively correlated with meaning in life and high levels of interference were negatively correlated with meaning in life. Contrary to expectation interference and action identification were not associated. Further analyses showed that inclusion of depression, acceptance and optimism eliminated the effect of pain interference but only optimism abolished the effect of action identification.

Conclusion: Chronic pain patients holding higher levels of action identification report a greater sense of meaning in life. Meaning in life is also associated with the amount of interference of behavioural activity. The anticipated relationship between action identification and interference was not observed. The present evidence suggests that interference and action identification contribute independently to a person's sense of meaning in life.

1. Introduction

Patients with chronic pain say things like, 'I don't think of tomorrow, I just take every day as it comes'. This suggests that chronic pain may prevent movement towards valued goals [1,2]. As engagement in relationships and occupation diminishes, a person's sense of purpose, efficacy, self-philosophy and self-worth can be challenged. Other authors have suggested pain necessitates patients to revise their life goals and expectations yet the need remains for specific research into the cognitive-emotional processes underlying this link between meaning in life and adjustment to pain [3]. We chose to examine one such cognitive process: the way in which pain patients' think about their everyday behaviour. To the best of our knowledge this is the first investigation of how thinking about what one is doing might relate to an overall sense of meaning in chronic pain patients.

In this article we report an initial study examining the relationships between the interference with life attributed to pain, the meaning ascribed to everyday behaviour and a person's sense of

DOI of refers to article: http://dx.doi.org/10.1016/j.sjpain.2015.08.001.
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http://dx.doi.org/10.1016/j.sjpain.2015.04.024
1877-8860/

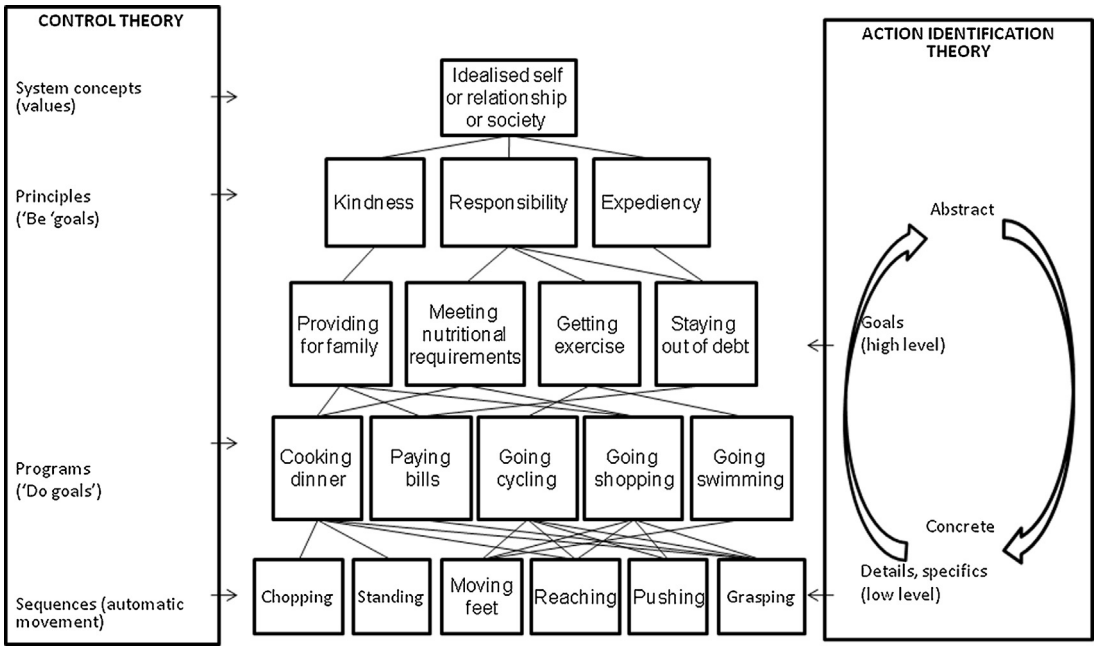

Fig. 1. This figure provides a schematic illustration of the theoretical frameworks used in the development of the study. The levels of Carver and Scheier's self-regulatory control theory are shown on the left. Exemplars of each level are provided in the centre, illustrating the interconnected hierarchical arrangements between action and meaning. The right side schematizes action identification theory and indicates the dynamic change in identification between low level concrete and high level more abstract descriptions of an action. See text for more details. In developing a measure of action identification suitable for pain patients we nominated programme level activities such as cooking dinner and generated two descriptions of the activity: a low level descriptor corresponding to the sequences level of self-regulatory control theory, and a higher level description of a programme that was not completely abstract.

meaning in life. We used a theory of the cognitive representation and organization of behaviour, Action Identification Theory [4], to inform the development of the study. Action Identification Theory (AIT) states that any behaviour can be thought of in several ways: one person might construe that they are 'chopping vegetables', another might construe the same behaviour as 'cooking dinner' and third person might construe it as 'trying a new recipe'. Each mental construal holds a different level of meaning, ranging from cognitive representation of automatic movement sequences to representation of goal-oriented activities. Thus the construals can be arranged hierarchically in relation to personal significance and value. This hierarchical arrangement has been formally conceptualized in theories of the organization of behaviour, e.g., control theory [5], and the cognitive representation of action, e.g., Action Identification Theory (AIT) [4], as illustrated in Fig. 1.

Briefly AIT proposes that mental construals of behaviour, or act identities, vary systematically. Low level act identities are more concrete, they concern the details and specifics of a behaviour indicating how it is done, e.g., the cyclist who is 'pushing peddles' [6]. High level act identities are more abstract and reflect a general understanding of the effects and implications of behaviour. These high level identities are more likely to reflect the implementation of one's goals in accordance with personal values, e.g., the cyclist who is getting exercise in order to stay healthy. Adopting a high level identity brings about greater means of achieving goals, e.g., the cyclist may also swim or run in pursuit of getting exercise. AIT holds that three fundamental principles guide the level at which a person thinks about (construes) what they are doing: (1) behaviour is maintained with respect to its focally attentive or *pre-potent* act identity; (2) there is a tendency for higher level act identities to become pre-potent as people search for meaning provided by the context in which they are acting; and (3) when something disrupts an action and it cannot be maintained in terms of its pre-potent act identity, a lower level act identity becomes pre-potent [4,6]. AIT proposes that the pre-potent identity will change according to circumstances. At any one time the pre-potent identity can elicited in answer to the question 'What are you doing?' For example, the pre-potent identity when pressing a button to call an elevator may be 'I am going to visit my friend who lives on the top floor', but if the elevator is malfunctioning you might press the button several times and the question 'What are you doing?' will evoke an answer 'I'm trying to call the elevator.' The same act now has a different, more mundane, identity. AIT proposes that the pre-potent identity will change according to the circumstances in which one is behaving. Specifically, the more difficult an action is to maintain in terms of actual difficulty of the behaviour, familiarity with the behaviour, complexity of the behaviour and time taken to learn and enact the behaviour, the lower the level at which it is identified [7].

We conjectured that the extent to which pain interferes with behavioural acts will determine the degree to which a person consistently adopts low level meaning (principle 3). In other words, the habitual disruption to everyday behaviour caused by pain means low level identities become most accessible (pre-potent) as behaviour becomes more difficult to maintain. We surmise that repeated interference by chronic pain of activity changes the level at which a person identifies individual behaviours, in turn this reduces the extent to which the person finds meaning in life, as low level identities are devoid of personal meaning. This has implications for progress in attaining life goals and thus ability to maintain a continuous and valued sense of self [8].

2. Overview of studies

Understanding the linkage between behaviour and thoughts about that behaviour has long been a major aim of cognitive behaviour therapy. The well-known fear avoidance model has arguably been highly successful in identifying a particular subset of behaviour-thought relationships [9]. The preceding brief account of action identity theory suggests its possible application to further understanding the relationship between behaviour and thought and their consequences in a broader context. The account has been

Table 1
Sample items of the Behaviour Identification Form (BIF) and the Action Identification in Pain (AIP) measure.

BIF	AIP
6. Chopping down a tree	1. Cleaning the house
a. Wielding an axe	a. Vacuuming the floor
b. Getting firewood*	b. Showing one's concern for cleanliness*
10. Paying the rent	21. Dressing myself
a. Maintaining a place to live*	a. Putting on clothes
b. Writing a cheque	b. Getting ready to go out*
25. Pushing a doorbell	25. Walking up and down hills
a. Moving a finger	a. Taking exercise*
b. Seeing if someone's home*	b. Putting one foot in front of the other

* High level act identity.

presented as a causal narrative but given the absence of other studies and suitable measures it is not possible to provide a test of causality at present. The two studies reported in this article aimed to develop a measure of action identification suitable for use within a population with chronic pain (Study 1) – the Action Identification for Pain (AIP) scale. In Study 2 we use the AIP to test the implications of Action Identification Theory.

2.1. Study 1: the construction of the Action Identification for Pain (AIP) measure

Vallacher and Wenger developed the Behaviour Identification Form (BIF) [10] to assess act-specific and individual differences in action identification level by distinguishing between low level and high level act identities. In designing the BIF Vallacher and Wegner avoided high level identities likely to be seen as unanticipated or unpleasant consequences of action and specified high level identities that were goal-like and fairly positive in nature. This was because the focus concerned the characteristic level at which people attempt to maintain rather than avoid action. To overcome the potential problem of respondents feeling obliged to select meaningful (thus high level) identities low level identities were designed as valid descriptions of the act [10]. Thus high level identities reflect the implementation of one's goals, values and interests while low level identities are devoid of such meaning and self-defining potential. The BIF comprises 25 items in the form of stems describing a goal-oriented action at the mid-level of identification and two statements that identify the action at higher and lower levels accompany each stem. Respondents are asked to endorse a single identification statement that captures their view of the action. Examples of the BIF items are shown in Table 1. High level act identities are scored '1' and low level act identities are scored '0'. A total action identification score is obtained by summing scores for all items. The BIF has satisfactory internal consistency ($\alpha = 0.84$) and test–retest reliability ($r = 0.96$) over 2 weeks [4].

In reviewing the BIF we concluded that many of the items lacked relevance for people with chronic pain. Many of the cited activities would be difficult to engage in and are unlikely to be age or gender relevant, e.g., joining the army and climbing a tree. In contrast everyday acts of living, e.g., doing the ironing, may not necessarily be enjoyable to perform but people engage in them as they are necessary for their longer-term interests such as looking presentable, or for avoiding negative consequences, e.g. looking scruffy. These activities have the potential to be disrupted by pain, thus enabling investigation into the way in which people with chronic pain derive meaning in their day-to-day activities.

The purpose of the first study was to construct a measure of action identification for use with people with chronic pain; the Action Identification for Pain (AIP) measure. We followed the analytical methods described by Vallacher and Wegner [6] in the development of the BIF to ensure as much comparability as possible: The significant difference between the measure developed in this study and Vallacher and Wegner's measures lies in the content of the measure. The present study comprised three stages.

Ethical approval for Study 1 was obtained from the University of Leeds.

2.2. Stage 1: item section

To ensure maximum content validity for people with chronic pain we developed a pool of items informed by items drawn from published scales assessing disability and function. An extensive literature review of existing measures of disability and functioning in chronic pain was conducted. Relevant measures and appropriate search terms were first identified in the *Handbook of Pain Assessment* [11]. Independent searches using the title terms 'pain disability', 'pain functioning', 'measuring pain', 'pain inventory', 'pain index', 'problem inventory', 'sickness impact', 'pain measures', 'limitations profile' and 'measuring disability' were then run using two electronic databases in OVID: PsycINFO (1806 to January Week 1, 2010) and MEDLINE (1950 to December Week 5, 2009). To ensure generalizability of the items, measures that are typically only used in a population with a specific type of pain, or in a population of a specific age, gender or culture, were excluded. Those published in non-English language journals were also excluded. Measures retained were, the Chronic Illness Problem Inventory [12], Groningen Activity Restriction Scale [13], Pain Disability Index [14], Sickness Impact Profile [15] and West Haven-Yale Multidimensional Pain Inventory [16].

From these questionnaires we extracted 55 separate items and then constructed a 'mid-level' description (identity) of the behaviour. These 55 mid-level behaviours formed item stems which took the same format as the BIF, e.g. 'joking with family members'. We then drafted both high level act identities and low level act identities for each item stem. Table 1 gives examples and illustrates the comparability between the new measure (AIP) and the BIF. The high and low level identities were developed in accordance with Vallacher and Wegner's hierarchy of perceived functional asymmetry, whereby a high level act identity is performed *by* performing a mid-level identity, which is performed *by* performing a low level identity. For example, 'one sees if someone is home *by* pushing a doorbell, and one pushes a doorbell *by* moving a finger' [6].

2.2.1. Stage 2: validity of level of identities

As a check on the validity of the level of identities we prepared a questionnaire containing 110 items each consisting of a stem followed by either the high level act identity or the low level act identity. Each stem occurred a second time with the alternative identity. For each item, participants had to read the stem and identity and then indicated whether they judged the identity was high level or low level. There was also a space beside each item to note any free text comments regarding the appropriateness and ease of completing the item. The order in which the high level act identity and low level act identity occurred for each stem was counterbalanced in a second version of the questionnaire.

We recruited 25 clinical psychologists in training (6 males) via email. A brief information sheet described the essence of AIT and the definitions of high level and low level identification. The proportion of participants answering an item who rated the identity as the same level as intended by the researcher was calculated for each identity. This was termed the agreement score and took a value between 0.00 and 1.00. We set a criterion for inclusion of an item into the AIP in which both the high level identity and the low level identity had an agreement score of 0.65. We reasoned that 0.65 was a sufficient minimum agreement score which also allowed enough items to be retained for future analyses concerning the internal validity and measurement consistency of the measure. Using the

0.65 criterion we identified 40 potential items. Of the remaining 15 items, 6 intended low level items were identified as high level and 9 intended high level items as low level.

2.2.2. Interim comment

The item pool was established using a sample of convenience. It is unknown whether action identification relates to gender or academic achievement, though in their analysis of the BIF, Vallacher and Wegner [10] found no differences in action identification between males and females, or between undergraduate students, university employees, gynaecology outpatients and juvenile detainees. Importantly, all items were adapted from existing measures of disability and functioning in chronic pain. For this reason it is unlikely that gender and academic biases, if they existed, would have significantly reduced the suitability of the item pool for use in a population of people with chronic pain. All items concern common activities relevant to most people. The item pool was also reviewed by a number of health service users present at a research interest group. They commented that the items were suitable and easy to complete and encouraged the continued development and validation of the AIP.

2.3. Stage 3: initial psychometric properties of the AIP

The purpose of this stage was to explore the basic psychometric properties of the AIP. Following the completion of stage 2 we developed a questionnaire version of the AIP using the same principles as those used in the BIF. Each item stem was paired with its high and low level act identities. Both identities were placed below the stem, the upper one was labelled **a**, and the lower **b**. The spatial location of high and low act identities was counterbalanced across items: see Table 1. The measure is essentially a forced choice one as respondents are asked to select one of two act identities.

2.3.1. Participants

Undergraduate students studying at the University of Leeds were recruited across all Faculties via email. They were invited to complete the AIP and provide basic demographic information.

2.3.2. Procedure

Data collection was via an online testing facility. On entering the website, participants were presented with the ethics-approved information page and a consent page. They were then asked to provide some basic demographic data (age, gender, faculty under which they studied and whether English was their first language). They were then taken to an instructions page which read as follows:

> "Any behaviour can be identified in many ways. For example, one person might describe a behaviour as "pushing a doorbell", while another might describe the behaviour as "moving a finger". Yet another person might describe the behaviour as "seeing if someone's home". We are interested in your personal preferences for how a number of different behaviors should be described. On the following page you will find several different behaviors listed. After each behavior there will be two choices of different ways in which the behaviour might be identified. Here is an example:
>
> 1. Attending class
> a. sitting in a chair
> b. learning new information
>
> Your task is to choose the identification that best describes the behaviour for you. Simply check the space beside the identification statement that you pick. Please mark only one alternative for each pair. Of course, there are no right or wrong answers. People simply differ in their preferences for the different behaviour descriptions, and we are interested in your personal preferences. Make sure you mark your choice for each behaviour. Remember; choose the description that you personally believe is more appropriate in each pair."

2.3.3. Results

A total of 269 undergraduate students (104 males, 165 females) returned useable data. Most participants had English as a first language ($n = 245$) and were aged between 18 years and 23 years old ($n = 260$).

High level identities in the AIP were scored 1 and low level identities scored 0. The mean total score = 25.09, $SD = 5.90$, range 6–40. The data were normally distributed. There were no significant differences between males and females in the total score. For the majority of items, at least 20.0% of participants selected each identity. For the following items fewer people chose the low level act identity: 'doing the shopping' (9.7%), 'taking a holiday' (14.5%), 'laughing' (10.4%), 'taking care of business affairs' (6.3%), 'doing leisure time activities' (16.0%), 'listening to other people's problems' (7.4%), 'being affectionate' (11.9%), 'going out for entertainment' (12.3%), 'concentrating' (7.4%) and 'caring for myself' (12.3%). There was therefore a tendency to endorse items at the high level act identity. We however, chose to retain all items because the main hypothesis to be tested in the subsequent study predicted that pain patients might preferentially select low level identities in proportion to the level of interference. The full text of the AIP, items and instructions, is given in Appendix 1.

Following the precedent set in the construction of the BIF we computed Cronbach's α. It was satisfactory ($\alpha = 0.80$) and similar to the level reported in the original BIF (0.84). Item-total correlations ranged from $r = 0.15$ to $r = 0.41$ and were not improved by removing any items.

Following Vallacher and Wegner [10] we conducted a principal components analysis to test the possibility that the AIP tapped action identification tendencies specific to subsets of items, i.e., there was more than one factor. An overall Kaiser–Meyer–Olkin statistic of 0.712 (and individual item statistics all exceeding 0.500) indicated that the data was likely to factor well. Bartlett's Test of Sphericity was highly significant ($P < .001$) thus the correlation matrix was not an identity matrix indicating that there was some relationship between the items and principle component analysis was appropriate. Kaiser's recommended criterion of retaining all factors with eigenvalues greater than 1was used [17]. A principal component analysis revealed the existence of one primary factor (Eigen value = 4.83) and thirteen minor factors (Eigen values = 2.29–1.04). 23 of the 40 items had their highest loading on the primary factor and all other items also had positive loadings on this factor (0.18–0.38). We also tested the fit of a possible rotated factor structure however a direct oblimin rotation failed to provide an alternative solution after 25 iterations.

2.3.4. AIP test–retest stability

We tested the stability of the AIP by recruiting 31 postgraduate students and inviting them to complete the AIP on two occasions.

The mean length of time between the two administrations of the AIP was 18.39 days (minimum = 13 days, maximum = 67 days, SD = 12.23), with the majority of participants having completed their participation within 2–3 weeks ($n = 28$). The satisfactory internal consistency of the AIP found in the previous study was replicated in this sample (Cronbach's α at time 1 = .817, Cronbach's α at time 2 = .882). A test–retest analysis revealed a positive correlation ($r = 0.788$, $P < .001$, $n = 31$) between total action identification score at time 1 and total action identification score at time 2. Pearson's r was not altered when controlling for test–retest time ($r = .787$, $P < .001$), and increased slightly when an outlier (long

duration between completion times) was removed from the analysis ($r = .838$ $P < .001$, $n = 30$).

2.4. Discussion

The aim of this study was to develop a measure of action identification suitable for use with people with chronic pain and physical health problems. As a first step we tried to ensure that it had face and content validity, and met basic psychometric criteria for reliability. The AIP seems to be a promising measure. The wide variety of ordinary daily tasks included makes it suitable not only for use in a population of people with chronic pain but a broader population. The observed mean score (25/40) for the student sample was above the midpoint of 20 which would be have been expected if participants had responded at random to the test items. A similar pattern of scores was observed by Vallacher and Wenger [10] in their development of the BIF. Content validity is built into the AIP by virtue of the items being derived following a systematic review of existing measures of disability and functioning in chronic pain, and the design being in accordance with AIT and the BIF. The AIP has satisfactory internal consistency, test–retest reliability and a factor structure, all of which equate well with the established BIF. Some items did not load most strongly on the primary factor, cross loadings were evident and factors did not have many strong loadings. These results were interpreted as the AIP being a scale which reliably measures level of meaning construed in action, but that additional sources of identity level variance, e.g. individual proficiency, familiarity with the act, action complexity, influence identification level for individual items. As these numerous sources of identity level variance are important components of AIT, all items were retained to ensure that the scale was not overly narrow.

2.5. Study 2: action identification and meaning in life – an exploratory study

The aim of this study was to test the hypothesized relationships between pain interference, action identification and meaning in life. Within the framework of AIT we conjectured that high levels of interference would be associated with an increased frequency of endorsing low-level action identities and a low level of overall meaning in life. In its strong form we conjectured that action identification might be a potential mediator between interference and meaning in life. The current literature indicates that depression and negative mood, acceptance, and optimism, are, to varying degrees, associated with meaning in life and pain interference. We therefore included measures of these constructs, first as a check on the validity of our measurement of meaning in life in a chronic pain sample, and second to explore potential unique contribution of action-identification.

A single group, multiple measures design was used. We made two specific predictions: (1) that greater pain-related interference would be associated with an increased selection of low level act identities, and (2) that increased selection of low level act identities would be associated with a decrease in the sense of meaning in life. As there was no prior data on action identification and meaning in life in chronic pain we elected to use a small to medium value of $r = 0.35$, $\alpha = 0.05$ and power = 0.80 to estimate a required sample size of 60 for a two tailed test and 49 for one tailed test [18]. The primary analyses were the inter-correlations between pain interference, action identification and meaning in life. Preliminary multiple regression models were explored. All analyses were computed using statistical software package SPSS version 20 [19]. Ethical approval was obtained from the UK National Health Service.

2.5.1. Participants

Participants were recruited over a five month period from UK National Health Service pain clinics based at 2 sites in a city in the north of England (population approximately 750,000). The inclusion criteria were non-malignant pain of at least 6 months duration, age 18 years and over and sufficient fluency in the English language to complete all measures. Of the 60 patients who agreed to take part, 13 either cancelled prior to interview or did not attend for their interview. Therefore, a total of 47 patients took part; 12 males and 35 females. No data was collected until the research interview (a condition of ethical approval) therefore information on patients attending the clinics who did not participate is not available.

2.5.2. Measures

2.5.2.1. Demographics. Basic demographic and clinical data were collected directly from participants: age, gender, pain duration, clinical diagnosis or cause of pain, site of pain and treatments or medications received for pain.

2.5.2.2. Pain interference: Brief Pain Inventory – short form (BPI-sf). The BPI-sf [20] is a commonly used self-report measure of pain intensity and pain interference over the past 24 h. For the intensity scale, the respondent is asked to rate their worst, least, average and current pain intensity on a 0–10 Likert scale, then scores for each item are summed. For the interference scale, the respondent is asked to rate how pain has interfered with 7 different life domains (e.g., normal work, relations with other people) on a 0–10 Likert scale and scores are summed. Satisfactory internal consistency for the intensity scale ($\alpha = 0.89$ and 0.82 in 2 independent samples) and the interference scale ($\alpha = 0.95$ and 0.93) has been demonstrated [21].

2.5.2.3. Meaningful Life Measure (MLM). The MLM [22] is a brief but comprehensive scale with 23 items comprising 5 subscales: exciting life (items 1–5), accomplished life (items 6–10), principled life (items 11–15), purposeful life (items 16–19) and valued life (items 20–23). The respondent is asked to rate their level of agreement with each item on a 1–7 Likert scale (with the exception of items 1, 2, 3, 16 and 17 for which the anchors are specific to the item). An overall meaning in life score is obtained by summing across items. Satisfactory internal consistency for each subscale of the MLM (α range from 0.85 to 0.88) has been demonstrated [22]. We used the total score in all analyses.

2.5.2.4. Depression: Patient Health Questionnaire (PHQ-9). The PHQ-9 requires the respondent to rate, on 0 to 3 Likert scales, how often in the last two weeks they have been bothered by each of 9 different symptoms of depression. The item total gives an overall index of severity of depression. The PHQ-9 has satisfactory internal consistency (alpha = 0.89 and 0.86) in two independent samples and test–retest reliability ($r = 0.84$) over 48 h [23].

2.5.2.5. Chronic Pain Acceptance Questionnaire – revised version (CPAQ-R). The CPAQ-R [24] is a commonly used self-report measure of acceptance of pain as defined by pain willingness, i.e., a recognition that strategies aimed at avoiding pain are ineffective, and activity engagement, i.e., pursuit of activities in spite of pain. The respondent is asked to rate each item on a 0–6 Likert scale. A total acceptance score is obtained by summing scores for all items. Satisfactory internal consistency has been demonstrated for both the pain willingness ($\alpha = 0.78$) and activity engagement ($\alpha = 0.82$) subscales [24].

2.5.2.6. Optimism: Life Orientation Test revised version (LOT-R). The LOT-R [25] is a commonly used self-report measure of dispositional

optimism which consists 3 items affirming optimism, 3 items disaffirming pessimism and 4 filler items. The respondent is asked to rate how much they agree with each item on a 0–4 Likert scale and a total score is obtained by summing scores for items. The LOT-R has satisfactory internal consistency ($\alpha = 0.78$) and test–re-test reliability ($r = 0.68$) over 4 months [25].

2.5.2.7. Action Identification for Pain (AIP). Given the novelty of the measure and the nature of the data collection protocol we converted the AIP into a forced choice card-sort method to maximize engagement with the task and to reduce the influence of method variance [26]. Each item from the questionnaire version of the AIP was presented individually on cards (12.7 cm × 7.6 cm) in the same format as the questionnaire. Participants were asked to place each card into one of two piles (A or B – marked on separate cards and placed left and right in front of the participant), depending on whether they preferred identity **a**, or identity **b** of each act. The instructions for administration of the card-sort were as follows:

"Any act can be identified in many ways. For example, if I asked you what you are doing now you might reply 'answering questions', or 'talking to you', or 'helping you with your research', or 'sitting in a chair'. There is any number of responses that you could give me. We are interested in your personal preference for how a number of different acts should be described. On the following cards (show the deck of cards) you will find several different acts. After each act will be two choices of different ways in which the act might be identified. For example (show practice card), the card might state the act 'attending class' and the two identifications a, 'sitting in a chair' and b, 'learning new information'. Your task is to choose the identification, a or b, that best describes the act for you. Simply place the cards into two piles depending on whether you prefer identification a or b. If you prefer identification a, put the card on pile A; if you prefer identification b, put the card on pile B. Of course, there are no right or wrong answers. People simply differ in their preferences for the different act descriptions, and we are interested in your personal preferences. Remember; choose the description that you personally believe is more appropriate in each pair."

2.5.3. Procedure

Participants were recruited at the pain clinic by a pain nurse specialist. Following ethical and consent procedures, an arrangement was made for the researcher to interview them either at the clinic or in their own homes. At the interview demographic and clinically relevant data was collected followed by administration of the BPI-sf and PHQ-9. These clinical measures were administered first so that perception of pain and mood were not influenced by subsequent questioning. Next, the AIP was administered followed by the MLM, CPAQ-R and LOT-R. Interviews lasted between 30 min and 110 min.

2.5.4. Results

Prior to data analysis we inspected the distributions of all measures. One participant was identified as an outlier on several measures by inspection of box and whisker plots and their data was removed from all analyses. Where participants had missed items, these were substituted with their rounded average value for that measure. Where participants had not completed a measure, their data was excluded from subsequent correlation analyses. The limited sample size available for analysis means that the analyses are underpowered. We therefore chose to use a bootstrap algorithm to estimate the confidence intervals for the inter-correlations and regression coefficients. The bootstrap estimates (5000 resamples) were made on a subset of participants ($n = 41$) who provided complete datasets. We report the observed sample statistics in the text and Table 2 reports the bootstrap estimates of the bias corrected and accelerated (BCa) confidence intervals for the correlations. Where the significance of the observed correlations is not in agreement with the bootstrap 95%CIs this is noted and indicated by the insertion of *BCa prior to the citation of the observed correlation. The bootstrapped confidence intervals for the regression coefficients are shown in Table 3. Exact probabilities are cited unless the value is smaller than $P = .001$.

2.5.4.1. Participants. We report data for 12 males (26.09%) and 34 females (73.91%). Mean age was 60.80 years ($SD = 12.43$). The majority of participants (58.70%, $n = 27$) experienced pain at multiple sites over their body. 9 participants (19.57%) said their primary site of pain was their back, 6 participants (13.04%) said legs and only 1 participant (2.17%) reported each of the following: arms, feet, abdomen and shoulder. The most common diagnosis (47.83%, $n = 22$) was spinal damage of some sort, e.g., degenerative condition, nerve damage. 12 participants (26.09%) reported a specific condition, e.g., amputation, fracture, hereditary neuropathy, multiple sclerosis, and 10 participants (21.74%) reported type of arthritis. Only 2 participants (4.35%) said that their pain was unexplained. 35 participants (76.09%) were taking pain medication, e.g., tablets, patches, injections, and 10 participants (21.74%) were combining pain medication with physiotherapy or other treatment, e.g., spinal cord stimulation or TENS. One participant (2.17%) was receiving no treatment.

2.5.4.2. Pain. Mean pain duration was 14.59 years ($SD = 10.64$), mean pain intensity (BPI-sf) was 21.44 ($SD = 6.26$) and mean pain interference (BPI-sf) was 38.02 ($SD = 15.46$). Intensity was significantly positively correlated with duration ($r = 0.31$, $P = .019$) and pain interference ($r = 0.40$, $P = .006$).

2.5.4.3. Meaning in life. The mean MLM score was 115.64 ($SD = 22.40$). As hypothesized, meaning in life was negatively correlated with pain interference ($r = -0.39$, $P = .006$). The greater the level of meaning a person perceived in life, the less pain interference they experienced. Meaning in life was significantly positively correlated with age ($r = 0.37$, $P = .013$) but uncorrelated with pain intensity ($r = 0.09$). We conducted a check on the validity of the MLM in the current sample by correlating it with previously established criteria. As expected meaning in life was positively correlated with acceptance ($r = 0.46$, $P = .003$) and optimism ($r = 0.54$, $P < .001$) and negatively correlated with depression ($r = -0.53$, $P < .001$).

2.5.4.4. Depression, acceptance and optimism. The mean PHQ-9 score was 10.41 ($SD = 6.63$) which falls within the 'moderate depression' category. Mean acceptance (CPAQ-R) was 57.20 ($SD = 14.66$) and mean optimism (LOT-R) was 13.12 ($SD = 4.46$). As might be expected, some inter-correlations between the psychological variables and the pain variables were observed. In sum, depression was negatively correlated with age ($r = -0.37$ $P = .012$) and acceptance (*BCa $r = -0.35$, $P = .026$) and positively correlated with pain intensity (*BCa $r = 0.35$, $P = 019$) and pain interference ($r = 0.73$, $P < .001$). Acceptance was negatively related to pain interference ($r = -0.37$, $P = .016$). Optimism was also negatively related to pain interference ($r = -0.33$ $P = .038$).

2.5.4.5. Action identification. Satisfactory internal consistency of the AIP was replicated in the current sample ($\alpha = 0.76$). Mean action identification was 26.35 ($SD = 5.54$) which was not significantly different from that of the undergraduate sample used in the psychometric evaluation of the AIP ($t_{(313)} = -1.35$, $P = .178$). As hypothesized, action identification was positively correlated with meaning in life ($r = 0.31$, $P = .039$). People who identified actions at a higher level experienced a greater sense of meaning in life. Action identification was also positively correlated with

Table 2
Bootstrap (BCa) 95% upper and lower confidence intervals for the inter-correlations, number of sample = 5000; $N = 41$; values in bold are significant, $P < 0.05$.

	BCa 95%CI	Pain duration	Pain intensity	Pain interference	Meaning in life	Depression	Acceptance	Optimism	Action identification
Age	Lower	−.369	−.443	−.491	***.089***	***−.540***	−.131	−.084	−.319
	Upper	.216	.179	.040	***.518***	***−.087***	.314	.575	.233
Pain duration	Lower		***.086***	−.011	−.424	−.086	−.464	−.346	−.441
	Upper		***.624***	.539	.223	.430	.156	.350	.212
Pain intensity	Lower			***.057***	−.290	−.056	−.220	***−.459***	−.130
	Upper			***.594***	.324	.567	.373	***−.001***	.329
Pain interference	Lower				***−.557***	***.528***	***−.619***	***−.545***	−.349
	Upper				***−.118***	***.824***	***−.082***	***−.059***	.284
Meaning in life	Lower					***−.707***	***.137***	***.209***	***.059***
	Upper					***−.299***	***.726***	***.783***	***.560***
Depression	Lower						−.670	***−.503***	−.457
	Upper						.095	***−.047***	.178
Acceptance	Lower							−.111	−.240
	Upper							.557	.410
Optimism	Lower								***.049***
	Upper								***.610***

optimism ($r = 0.37$, $P = .016$). Contrary to our prediction action identification was not significantly correlated with pain interference ($r = 0.07$).

2.5.4.6. Exploratory multiple regression analyses. The absence of a significant relationship between pain interference and action identification indicates that the hypothesis that relationship between interference and meaning in life might be mediated through an association with action identification should be rejected in this instance. However we conducted a series of multiple regression analyses to explore the relationship between action identification and interference on meaning in life and the three established measures of depression, optimism and acceptance. Given that these variables were correlated with meaning in life, action identification and interference we tested the impact of adding each of them to the regression with the aim of identifying if they eliminated the effects of action identification and interference on meaning in life. Checks for multicollinearity and homoscedasticity were met, and errors were normally distributed. Results are displayed in Table 3 which reports observed B and β coefficient and the associated P value. Table 3 also shows the 95% confidence intervals from a bootstrap analysis.

In the base model (Model 1) pain interference and action identification were simultaneously entered and accounted for 23.7% of variance in meaning in life score. Both pain interference ($\beta = -0.38$) and action identification ($\beta = 0.30$) contributed significantly to variance in meaning in life. In Models 2–4 the entry of the additional variable always increased the prediction (increases in adjusted R^2) and also resulted in the removal of interference as a significant statistical predictor of meaning in life. This was so for both the models based on the sample and for the bootstrapped confidence intervals suggesting that each of these variables shares significant variance with interference. The findings with regard to action identification were more variable. When depression was included in the regression (Model 2) the influence of action identification was marginal according to the sample analysis ($P = 0.052$) but the bootstrap derived confidence intervals suggested that the B coefficient was greater than 0. Action identification retained predictive influence when acceptance was entered (Model 3) and this was true for both the sample and bootstrap analysis. However the bootstrap analysis suggests that the B coefficient for acceptance may be somewhat marginal as the bootstrapped 95% confidence intervals encompass the 0 point. The final analysis with optimism (Model 4) indicated that action identification had no predictive value when optimism was introduced and this was true for both the sample and

Table 3
Summary of standard multiple regression models with the meaning in life measure (MLM) as the dependent variable. In *Model 1* pain interference and action identification were entered as the sole predictors. In *Models 2–4* depression, acceptance and optimism were also added the values and β and its associated P value are shown in the last two columns. Bootstrap values (BCa) from 5000 resamples for the standard errors of B are given.

	B	BCa 95% confidence interval		β	P
		Lower bound	Upper bound		
Model 1 $F_{(2, 42)} = 6.53$, $P < .003$, $R^2 = .24$, *adjusted* $R^2 = .20$					
Pain interference	−.56	−.96	−.22	−0.38	.008
Action identification	1.21	.27	2.25	0.30	.033
Model 2 depression $F_{(3, 41)} = 7.28$, $P < .001$, $R^2 = .35$, *adjusted* $R^2 = .30$					
Pain interference	−.06	−.61	.49	−0.04	.815
Action identification	1.03	.24	1.95	0.25	.052
Depression	−2.91	−.43	−.64	−0.47	.012
Model 3 acceptance $F_{(3, 37)} = 6.00$, $P < .002$, $R^2 = .33$, *adjusted* $R^2 = .27$					
Pain interference	−.31	−.73	.14	−0.21	.158
Action identification	1.16	.30	2.25	0.29	.042
Acceptance	.53	−.03	1.34	0.35	.022
Model 4 optimism $F_{(3, 37)} = 6.68$, $P < .001$, $R^2 = .35$, *adjusted* $R^2 = .30$					
Pain interference	−.31	−.81	.15	0.17	.140
Action identification	.69	−.40	1.89	0.10	.248
Optimism	2.03	−.02	3.63	0.39	.010

bootstrap analysis. However, as with the analysis of acceptance, the bootstrap analysis for optimism suggests that the B coefficient may be somewhat marginal.

3. Discussion

The purpose of the current research was to explore the implications of Action Identification Theory for understanding the relationship between action, interference and meaning in chronic pain patients. The explicit conjecture derived from the theory was that ongoing interference to cognitive and behavioural acts attributable to chronic pain changes the level at which a person identifies action and thus reduces the sense of meaning in life. We acknowledge that neither study can test the causal aspect of the conjecture: We tested only for basic association. We found support for two of the three expected relationships. First, pain interference negatively correlated with meaning in life, as was expected based on existing literature. For example, Breivik et al. [27] investigated the impact of chronic pain in 15 European countries and Israel. They found that chronic pain of moderate to severe intensity seriously affected perceived ability to fulfil social and occupational activities. The ability to fulfil such worthwhile activities is necessary to attain life goals thus is a pre-requisite of a valued, meaningful life [22]. Second, action identification, as measured by the AIP, positively correlated with meaning in life. Again this was expected based on the literature on AIT. Higher levels of action identification infer more meaning thus hold greater self-defining potential which helps to maintain a continuous and valuable sense of self [6]. Both pain interference and action identification contributed significant variance in meaning in life.

Contrary to prediction we found no relationship between pain interference and the level of action identification and evidence for the hypothesized mechanism by which pain interference might alter a person's sense of meaning in life was not forthcoming. Prior to dismissing this hypothesis other factors might be considered. First, it may be that the precision of measurement of the constructs is not sufficiently refined. Dezutter et al. [3] in their study of meaning in life in chronic pain patients found presence of meaning (seeing significance in life and having purpose) was distinct from and not correlated with search for meaning (desires and efforts to establish meaning). Therefore it could be that interference (BPI-sf) and action identification (AIP) differentially concern these independent entities and so are influenced differently by an individual's meaning 'profile', e.g., high search and low presence; low search and low presence. There may have been other compromises to the precision of measurement of the constructs in particular we note that interference was assessed with a relatively short scale that requires participants to endorse general statements. In contrast the measurement of action identification required endorsement of more specific items. However, using a longer scale with more specific items to assess interference would introduce criterion contamination in the measures. There is evidence that low mood (depression) is associated with a bias to endorsing the extremes of generalized statements [28,29] and the possibility arises that the measure of interference is biased by current mood. Conversely the items in the AIP might not be relevant to all participants and this might bias the assessment of action identification. Improved measurement of both variables might be obtained if participants reported on both the personal relevance of the actions and the degree of interference. Another possibility for the lack of correlation between pain interference and action identification concerns the implications of habitual high or habitual low level identification. A review of the current literature [30] concluded that low level thinking (concrete descriptions of acts) may be necessary for goal initiation because of an initial need to focus on aspects of feasibility. However, progress towards goals is hindered if this low level thinking continues because meaning, i.e., the reason for doing, is lost. This probably results in eventual withdrawal from continuing with 'doing'. While high level identification is necessary for progress for existing goals, without the necessary focus on feasibility, i.e., low level identification, particularly as pain makes action more difficult, goal initiation is compromised thus withdrawal from activity probably occurs in this instance also. Thus habitually identifying action at a too low or too high level and not having capacity to adapt flexibly to an appropriate level of identification may be detrimental to functioning and it may be perceived as greater interference. Future research might consider goal initiation as well as goal progress in relation to high level identification, low level identification, action identification flexibility and subsequent implications for functioning, i.e., level of pain interference perceived, and meaning. This may help to clarify how interference relates to action identification.

We took measurements of three known correlates of meaning in life (depression, optimism and acceptance) and explored their impact on the relationship between action identification, interference and meaning in life. In separate analyses all three variables removed the association between interference and meaning in life, but the association between meaning in life and action identification was retained when depression and acceptance were controlled for. Optimism did however remove the association between action identification and meaning in life. The pattern of correlations indicates that depression, acceptance and optimism are primarily and strongly related to interference and meaning in life rather than to action identification, although optimism was correlated with action identification. Despite the small sample size and inability to infer causality, it seems reasonable to suggest that pain interference and low level action identification compromised sense of meaning in life, but that these mechanisms may operate at a level subsumed by the more global constructs depression, acceptance and optimism.

Depression, acceptance and optimism contributed significantly to variance in meaning in life. This is consistent with the growing body of evidence in support of acceptance and commitment based interventions [31]. Acceptance and Commitment Therapy (ACT) with chronic pain patients aims to help patients see that elimination or control of pain, i.e., trying to change and remove the pain, are unworkable strategies which maintain suffering and negative affect and in the long-term can result in isolation from work and social activities. Patients are encouraged to replace this struggle with a willingness to experience thoughts and feelings associated with pain and chose how best to respond. In other words, ACT aims to increase psychological flexibility [32]. ACT also focuses on behavioural changes necessary to create a more meaningful life via engagement in patterns of committed action that are consistent with personal values [33]. Optimism training may be another intervention with the potential to increase meaning in life in chronic pain [34].

3.1. Limitations

The AIP was developed to test the research hypothesis. Satisfactory internal consistency and test–retest reliability was demonstrated that were comparable psychometric properties to the established BIF. Following the precedent set by the developers of the BIF [4] we computed an internal consistency estimate. Conceptually this assumes that all the items are representative of a trait-like entity. We acknowledge that that assumption may be debatable in this context. The content validity was enhanced in the AIP by virtue of the items being derived following a systematic review of existing measures of disability and functioning in chronic pain. As yet there is no substantive evidence for the construct validity of the AIP. This can only be established over a series of studies [35]. Against our implicit expectation the mean AIP scores

for the clinical and student samples were not different. It is not clear why this might be so and given the multiple sources of difference between the groups it is possible that a third variable (age or depression) influenced action identification. As we obtained no other measures from the samples in Study 1 we cannot investigate this further. Alternatively, developments in AIT [30] suggest that low level 'thinking' may not become habitual, instead interruption to 'doing' might result in the adoption of an alternative high level 'thinking' which includes consideration of feasibility.

We acknowledge that the sample size in Study 2 is smaller than desirable and this has implications for generalization of the results beyond the immediate sample. We are however partly reassured by the results from the bootstrap analysis which suggest that observed results are reasonably robust for the population from which we sampled. The fact that the sample was drawn from a generic population of chronic pain patients, heterogeneous with regard to diagnosis but with prolonged experience of pain might be thought to be a limitation. This objection appears to be predicated on the assumption that diagnostic variability is not desirable because each diagnostic group has a unique psychological profile pertinent to the study of action identification. In other studies there is little evidence of psychological profiling being aligned to diagnostic groups. For example, classification on the basis of psychosocial variables using the Multidimensional Pain Inventory has repeatedly produced a classification irrespective of medical diagnosis [36]. Clearly further work would need to address the issue of heterogeneity.

3.2. Conclusions

Study 2 showed that chronic pain patients holding higher levels of action identification reported higher meaning in life scores. However the anticipated relationship between action identification and interference was not observed and on the basis of the present evidence it would seem that interference and action identification contribute independently to a person's sense of meaning in life. Exploratory multiple regression analysis suggested that unlike interference the measure of action identification retained its association with meaning in life after depression and acceptance were controlled for but not when optimism was included in the model. This is the first study to test the relationship between action identification and meaning in life and the new measure of Action Identification in Pain (AIP) requires further work and replication to establish its norms, validity and clinical use.

Disclosures

Helen Richardson was funded by NHS Yorkshire and the Humber Strategic Health Authority. The authors have no conflicts of interest to declare.

Conflict of interest

The authors have no conflict of interest.

Acknowledgements

We thank Kathryn Marczewski, Jo Bagley and Carol Bourke for facilitating recruitment; and Drs. Ganesan Baranidharan, Dudley Bush, Karen Simpson and Louise Lynch for access to clinics.

Appendix 1. The Action Identification for Pain measure

Instructions

Any behaviour can be identified in many ways. For example, one person might describe a behaviour as "pushing a doorbell", while another might describe the behaviour as "moving a finger". Yet another person might describe the behaviour as "seeing if someone's home". We are interested in your personal preferences for how a number of different behaviours should be described. On the following page you will find several different behaviours listed. After each behaviour will be two choices of different ways in which the behaviour might be identified. Here is an example:

1. Attending class

sitting in a chair ☐

learning new information ☐

Your task is to choose the identification that best describes the behaviour for you. *Simply check the space beside the identification statement that you pick. Please mark only one alternative for each pair.* Of course, there are no right or wrong answers. People simply differ in their preferences for the different behaviour descriptions, and we are interested in your personal preferences.

Make sure you mark your choice for each behaviour. Remember, choose the description that *you personally believe* is more appropriate in each pair.

Stem	High level identity	Low level identity
Cleaning the house	Showing one's concern for cleanliness	Vacuuming the floor
Writing or typing	Communicating	Putting words on a page
Joking with family members	Maintaining family relationships	Listening and laughing
Visiting friends	Maintaining friendships	Talking to others
At the cinema	Enjoying being entertained	Watching a film
Communicating by gestures	Emphasizing a point	Moving my hands
Lying down	Looking after myself	Being horizontal
Maintaining the garden	Making the garden look tidy	Pulling up weeds
Watching TV	Being entertained	Watching a screen
Doing the shopping	Getting essential supplies	Pushing a supermarket trolley
Using kitchen gadgets	Cooking a meal	Cutting up food
Paying bills	Staying out of debt	Handing over money
Preparing a meal	Meeting my nutritional requirements	Peeling vegetables
Working on a needed house repair	Taking pride in the house	Using a screwdriver
Washing the car	Taking pride in the car	Removing dirt
Taking a holiday	Having a break from routine	Leaving home
Going to a party or social function	Maintaining social networks	Talking to others
Eating out	Treating myself	Paying for food
Doing chores around the house	Maintaining the household	Tidying things away
Laughing	Expressing myself	Making a noise
Dressing myself	Getting ready to go out	Putting on clothes

Going to a park or beach	Getting some fresh air	Being outside
Taking care of business affairs	Getting organized	Writing a cheque
Spending time with relatives	Providing enjoyment	Sitting with family
Doing leisure time activities	Relaxing	Watching tv
Listening to other people's problems	Showing kindness	Not speaking
Learning new things	Becoming wiser	Remembering instructions
Working on a budget	Maintaining a lifestyle	Adding up bills
Being affectionate	Showing my love	Holding hands
Walking up and down hills	Taking exercise	Putting one foot in front of the other
Sleeping	Restoring my body and mind	Closing my eyes
Carrying on a conversation	Sharing thoughts with someone	Talking
Feeding myself	Gaining energy	Using a knife and fork
Reading	Gaining knowledge	Following lines of print
Tidying up	Making the house look neat	Putting things away
Going out for entertainment	Having fun	Going to the pub
Mowing the lawn	Maintaining the garden	Pushing a mower
Concentrating	Working something out	Watching something
Caring for myself	Maintaining my wellbeing	Cleaning my teeth
Cleaning the windows	Getting a better view	Using a sponge

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