

Design Guidance

Terminology – Elaboration

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Prepared by
Microsoft

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1 INTRODUCTION

This document provides guidance and recommendations with rationale for aspects of Terminology user interfaces related to Terminology Elaboration.

This document should be read in conjunction with the following Design Guidance:

- *Design Guidance – Terminology – Matching {R1}*
- *Design Guidance – Terminology – Display Standards for Coded Information {R2}*

1.1 Overview

This document is for anyone whose role includes screen design, implementation or assessment of a clinical application, and who is involved in creating or evaluating terminology user interfaces.

Terminology user interfaces operate within a note-taking environment. These environments fall into three categories (as illustrated in Figure 1 and described below), each of which requires different guidance:

- **Forms**
 - The user makes notes by selecting boxes and choosing options, not by entering text.
 - An encoding interface is not needed. The clinical codes should be embedded within the form itself or derived from combinations of entries in the form.
- **Single concept matching**
 - The user makes notes by typing the note for a single concept (such as 'asthma'), and the system returns SNOMED-CT®¹ {R3} matches. The user can then choose an appropriate match, refine the concept, then elaborate it with a combination of free text, qualifying SNOMED-CT attributes (such as 'severe'), and numerical values.
 - Encoding interfaces require components to match and elaborate SNOMED-CT concepts.
- **Text parser matching**
 - The user makes notes by writing unconstrained text, while the system matches words and phrases against the SNOMED-CT database, or a constrained subset of the database, and displays the matches. The user then has the option to do one of the following:
 - Confirm that they want to encode these SNOMED-CT expressions
 - Browse alternative matches
 - Refine a selected match
 - Leave the note un-encoded, in which case it will be saved as unstructured text rather than as a SNOMED-CT expression
 - Encoding interfaces require components to identify and match SNOMED-CT concepts, as well as build post-coordinated SNOMED-CT expressions, based upon attribute relationships, from within the text. The interface must also be able to identify terms and relationships from additional informational models in order to support accurate and comprehensive clinical noting.

¹ SNOMED-CT: <http://www.snomed.org/>

Figure 1 illustrates forms (left), single concept matching (centre) and text parser matching (right).

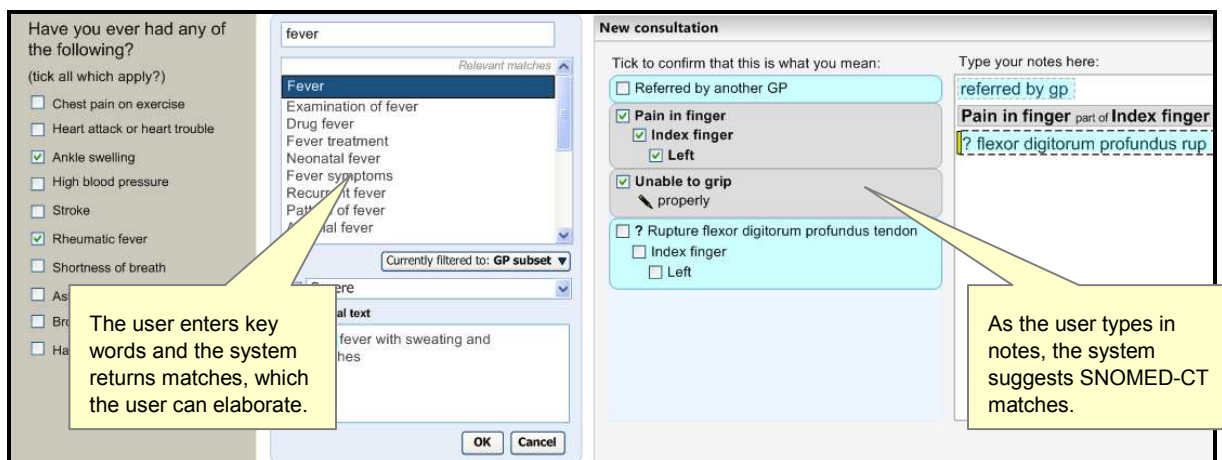


Figure 1: Styles of Encoding

A possible fourth hybrid category could be defined where forms may include areas where single concept matching or text parser is used.

Medical language is full of abbreviations and jargon, some of which have more than one meaning. By encoding clinical statements, they can be shared unambiguously. This should improve patient safety by reducing confusion, or errors, due to ambiguity in clinical notes.

Encoding also opens up important opportunities, such as:

- Filtering context specific views of medical records in order to improve searching
- Unambiguously sharing clinical statements between clinicians in different disciplines or institutions
- Using decision support mechanisms, based on codes within clinical statements, to enhance patient safety
- Auditing clinical activity by using codes to locate and report on specific types of information within patient records
- Researching clinical practice or outcomes by extracting codes from electronic patient records

SNOMED-CT is used in this Design Guidance as the terminology for encoding clinical statements.

1.2 Area of Focus

This document describes the elaboration of a SNOMED-CT expression, which could be a single pre-coordinated or post-coordinated expression comprising multiple concepts. Often, encoding an individual SNOMED-CT expression on its own will not provide sufficient meaning to match what the clinician wishes to express. In these cases, the concept requires some elaboration.

Elaboration could be as simple as adding some unstructured text to the expression to give the expression further meaning. Obviously the scope for future data manipulation is limited with free text elaboration. However, in order to give the clinician the freedom and flexibility to express their notes in a comprehensive and accurate manner, this type of elaboration is essential. Free text elaboration could be achieved by finding a SNOMED-CT expression and adding text to it (as in a single concept matching approach). Alternatively it could be done by matching a SNOMED-CT expression from within a passage of text, and leaving some of the text itself un-encoded, but at the same time associated with the encoded expression. The current Design Guidance deals with the former, for the latter see *Design Guidance – Terminology – Matching {R1}*.

Another type of elaboration involves post-coordinating a SNOMED-CT attribute (such as a qualifier) with the selected SNOMED-CT expression. This could be done by the system offering the user certain SNOMED-CT qualifiers to add to the selected expression. As we shall indicate, this should be limited to instances where this qualification is mandatory. This type of elaboration could also be achieved by the user typing in further notes for a selected SNOMED-CT expression, and the system offering SNOMED-CT matches that coordinate with the expression from within these notes.

Examples of common qualifiers include the attribute 'Severity', which has values such as 'Severe', 'Mild' and 'Moderate'. An example of potential mandatory attribute could be 'Laterality', of which the common values are 'Left' and 'Right', and which would apply to any relevant body structure concept.

All attribute relationships should be conformant with the published Context Model, and ideally further constrained appropriate (that is, sensible) sanctioning. Conforming to sanctioned relationships should optimise system behaviour.

A third type of elaboration involves the user adding or selecting numerical (or date and time) values for a SNOMED-CT expression. Given the importance of numerical values (such as measurements and timings) to clinical noting, the system must give the user every opportunity to record these values in their notes, and must sometimes actively encourage users to add these values. These values, and their relationships with SNOMED-CT expressions, are not modelled in the SNOMED-CT terminology, and will rely on an additional informational model of clinical statements. These may be expressions of time, such as 'for 3 days', or quantities plus their units, such as '42 mmol/l' for blood sugar level.

The area of elaboration is highlighted in the User Interaction Model, shown in Figure 2.

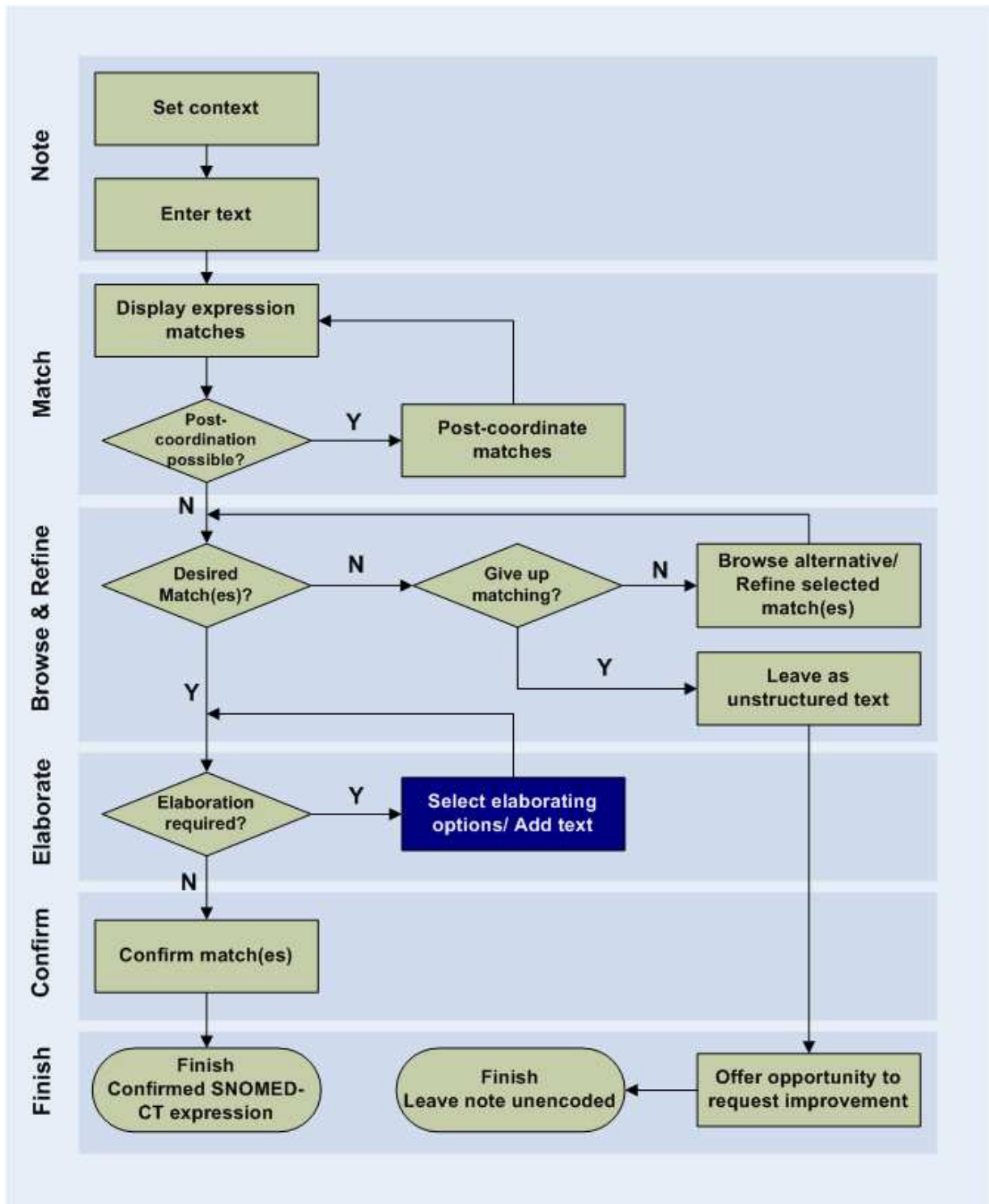


Figure 2: User Interaction Model

2 RECOMMENDATION AND GUIDANCE

Despite the wide scope of the terminology, individual SNOMED-CT concepts on their own will often not be sufficient to accurately and comprehensively reflect the encounter which the clinician is trying to express. There are three main areas that are covered in this guidance:

- Elaboration with free text
- Elaboration with SNOMED-CT attributes
- Elaboration with additional values

The first area concerns adding unstructured free text to a note, in order to give the SNOMED-CT concept a more qualified and accurate meaning.

The second area requires a form of 'post-coordination', or joining together, of existing SNOMED-CT concepts, in order to express a synthesised meaning. In the Design Guidance, we explore, in particular, where post-coordination is used to qualify or contextualise a given concept.

The third area involves adding structured data and relationships that will often need to be modelled outside of the SNOMED-CT terminology.

Notional Clinical Record

The guidance outlined in this Design Guidance is based upon assumptions about the composition of a clinical record. We assume in our 'notional clinical record' that the following rules will apply.

A single clinical record may comprise one or more 'notes' plus some contextual information, such as a heading (for example, 'past medical history').

A note will comprise of one of these:

- A pre-coordinated SNOMED-CT expression
- A post-coordinated SNOMED-CT expression
- A free text (non-SNOMED-CT) expression

In addition, each of these SNOMED-CT expressions may have a set of appropriate axis modifiers associated with it. These values may be:

- Default values
- User selected values

In addition each of the SNOMED-CT expressions may have the following associated with it:

- Non-SNOMED-CT numerical or time values, for example, reading measurements
- Free text

We will not allow:

- Numerical values to be recorded as values rather than free text if they are not associated with an encoded SNOMED-CT expression
- More than one expression to be saved, except in those instances where multiple concepts comprise a single 'composite'

Within each record entry there may be multiple 'notes', each of which comprise combinations of a SNOMED-CT expression, numerical/time values and free text. See Figure 3 and Figure 4.

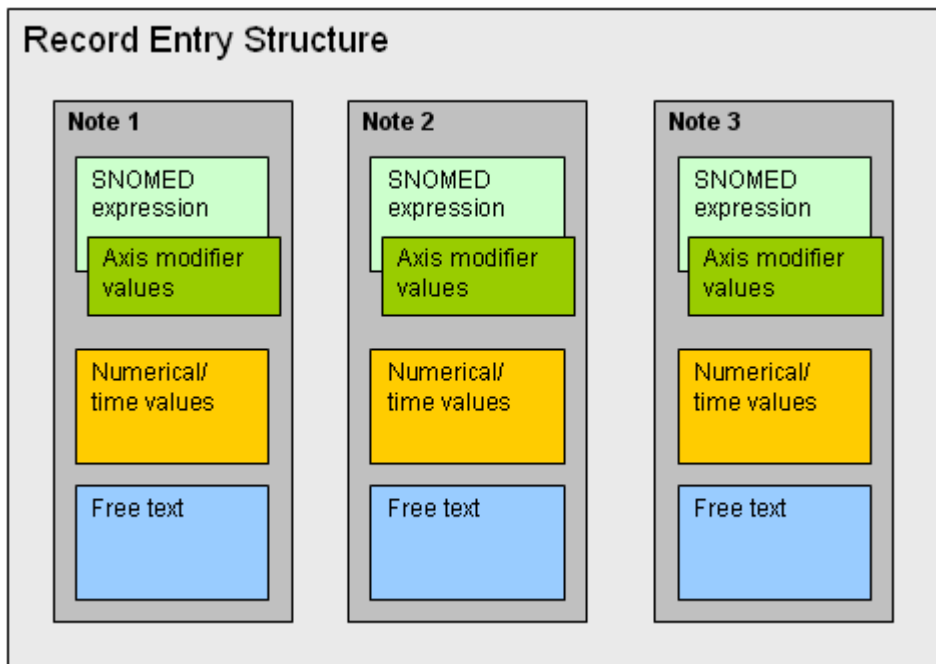


Figure 3: Structure of Notional Clinical Record Entry

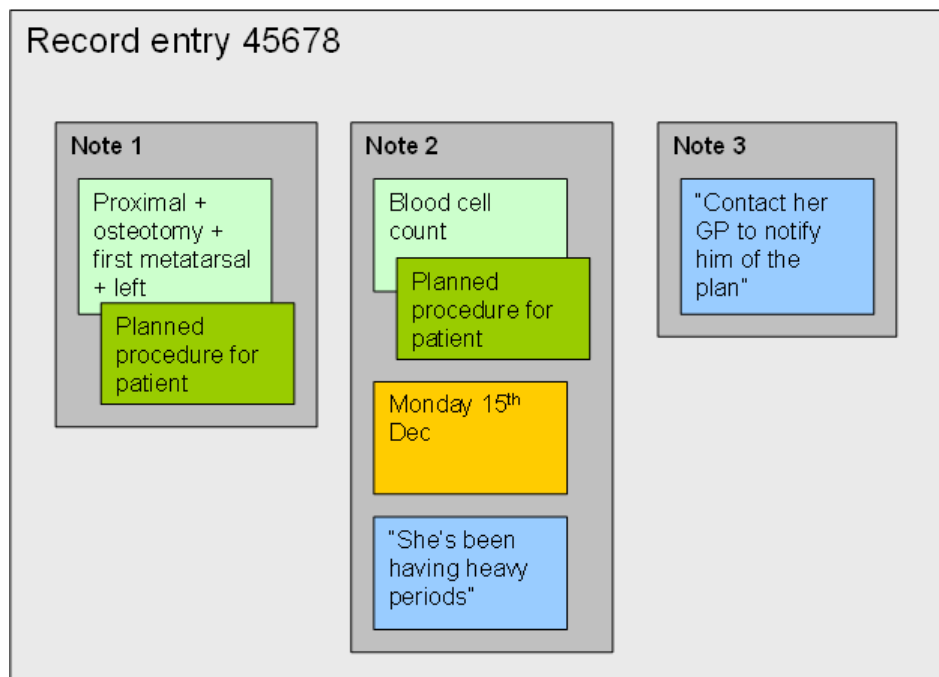


Figure 4: Example of Notional Clinical Record Entry Structure

2.1 Elaboration with Free Text

Despite the range and depth of SNOMED-CT, there may be many instances where expressing the specific nuance of what the clinician wants to say cannot be done by only encoding SNOMED-CT concepts. Also, the conceptual relationships required to articulate a statement may be lacking in the released SNOMED-CT data and may not be covered by additional information models at the system's disposal. In these cases, the clinician may want to choose a SNOMED-CT concept and elaborate it with 'free' text; that is, text that remains un-encoded at the point of saving the record. This might include non-clinical information, such as indicating the professions of a patient's parents.

Unstructured free text can be associated with a SNOMED-CT expression in both the single concept matching and text parser matching approaches.

As outlined in Figure 5, there are a number of functional areas in the standard 'encoding dialog', which is used in both the single concept matching and text parser matching approaches.

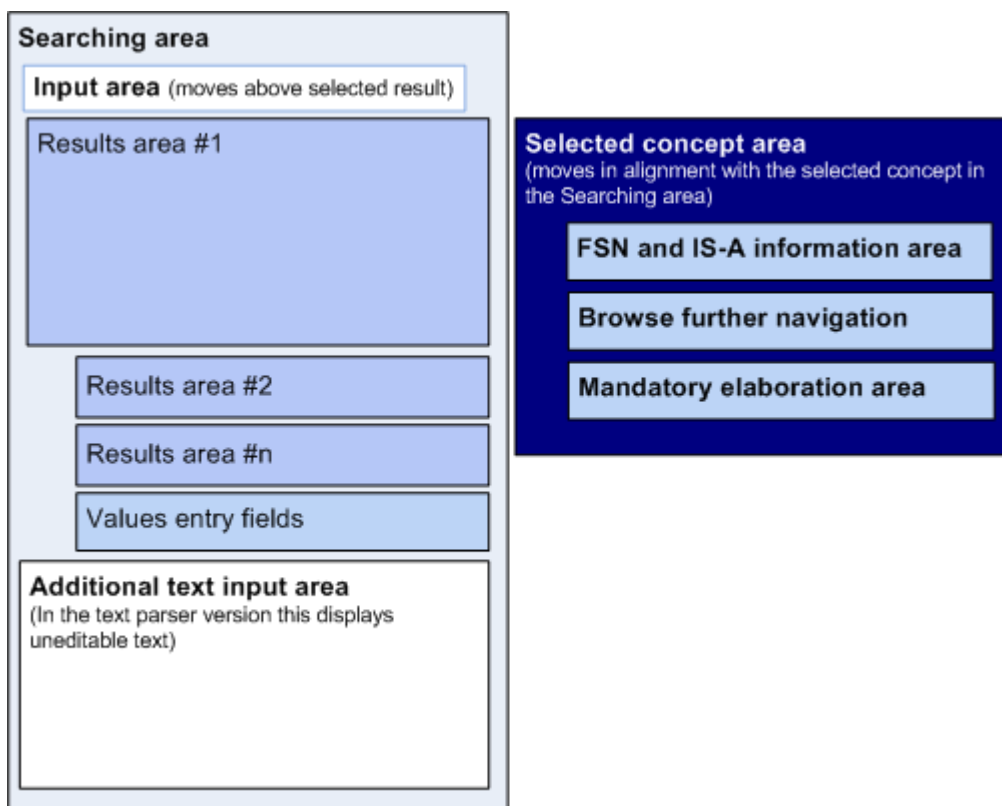


Figure 5: Functional Areas of Encoding Dialog

2.1.1 Additional Text

In the single concept matching approach, the user is presented with a text input field, labelled 'Additional text'. In addition to selecting a SNOMED-CT concept match, they may also type in free unstructured text, which will be associated with the concept. The additional text input field is featured within the encoding dialog, immediately below the list of SNOMED-CT matches.

The user selects the best match from the list of possible matches, and then types the free text into the additional text field, as illustrated in Figure 6 and Figure 7.

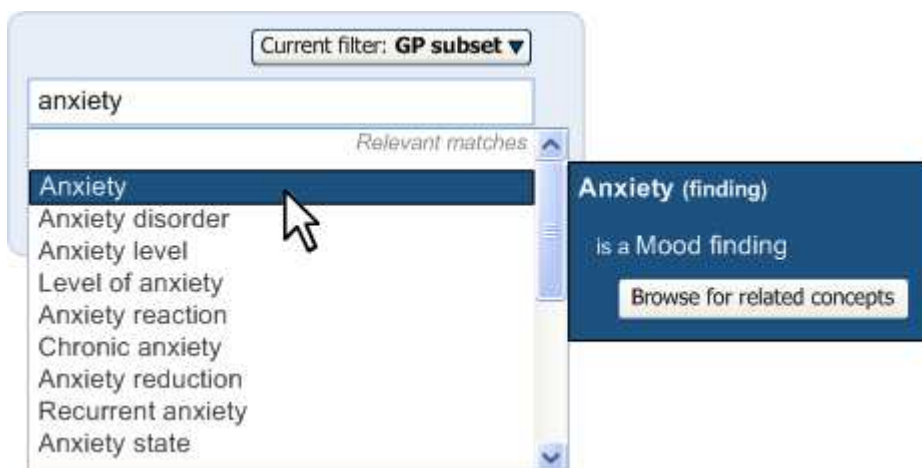


Figure 6: Selecting a Concept Match

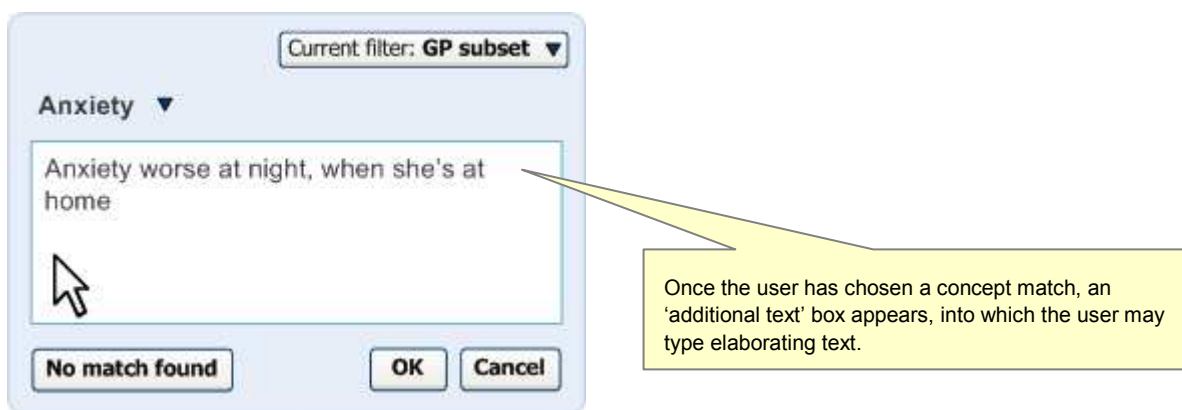


Figure 7: Entering Additional Text to Elaborate the Concept

2.1.1.1 Guidance

The system:

- Must allow the user to add free, unstructured text to a SNOMED-CT match selection
 - Must appropriately label the input field for adding free unstructured text
 - Should locate the additional text field in a position that is visible to the user when they are viewing the SNOMED-CT matches

2.1.1.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Align the additional text field with the field displaying the list of matches	See Figure 5	This should allow the user to scan down to the additional text field easily
✓	Provide an additional text field for all definition/elaboration dialogs in the 'Code and Elaborate' environment	See Figure 7	This is a universal feature that could apply to all concepts
✓	Retain the additional text until the user selects a code or closes the search dialog	n/a	Although text notes may apply to one concept, but not to another, users may be writing a lot of notes and using a concept as a 'hook' to hang the notes onto. Therefore, they will want the system to retain the unstructured text even if they change concept

Table 1: How to Use the Design Guidance

2.1.1.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	Do not locate the additional text field in the flyout area		
✗	Do not allow users to apply their own formatting to text in the additional text field	Users should not be able to apply styles, such as bold, or highlighting to text in the additional text field	Additional formatting would obstruct the communication of confirmed or encodable text
✗	Do not provide an additional text field for the 'text parser' approach to encoding	n/a	It would be confusing to offer two places to add unstructured text notes

Table 2: How Not to Use the Design Guidance

2.1.1.4 Benefits and Rationale

In the single concept matching approach, the additional text field must be located close to the matches list (and therefore, the selected SNOMED-CT match to which the elaboration will apply).

We had looked at featuring the additional text field in the flyout which, when tested, was understood. However, locating it in the flyout can appear strange, especially when the flyout is moving as the mouse moves down the list.

Featuring the additional text field in the same area as the list of matches does require an additional user action, namely single-clicking on the desired SNOMED-CT match (which turns the highlight grey) before clicking in the additional text field to write elaboration text. Alternatively, the user may write the text before selecting the list item, if they wish. However, despite a possible additional user action, it does make the process clearer.

Featuring the additional text below the selected match communicates that the text belongs to the match, and is an elaboration of the match. It also follows the more typical task order, which would be to select a match and then elaborate it.

2.1.1.5 Confidence Level

High

- Must allow the user to add free, unstructured text to a SNOMED-CT match selection
 - Must appropriately label the input field for adding free unstructured text
 - Should locate the additional text field in a position that is visible to the user when they are viewing the SNOMED-CT matches

2.1.2 Text Remaining Unstructured

In the text parser approach to matching, free text can be associated with a SNOMED-CT expression by not encoding text that falls within the expression envelope marquee. This may be the user's choice not to confirm a potential match for encoding (that is, by not selecting the appropriate check box), or it might be because the text cannot be matched with SNOMED-CT concepts (or data from additional information modelling).

In the example shown in Figure 8 (below), the user has typed in 'Unable to grip properly', from which the system has matched the concept 'Unable to grip' (ConceptID 284258001). The remaining text cannot be matched, but still falls within the user defined expression envelope (there are no full stops or carriage returns between 'Unable to grip' and 'properly') and the system has not associated the text 'properly' with any other matched concepts.

The text 'properly' appears in the suggested matching area, indented to the SNOMED-CT concept. It also features a special icon (currently undefined, but in this example, a 'pencil' icon has been shown) to distinguish it from the potential SNOMED-CT matches. Any free text will be displayed in this position (that is, below and indented to the SNOMED-CT expression).

If the free text is divided into two separate strings, these will be displayed as two bullets (that is, they would comprise two separate lines, each with an icon). For example, if the user had typed in 'David unable to grip properly', the system would display the concept match 'Unable to grip' and below this it would feature one line containing the text 'David' and another line containing the text 'properly'.

The screenshot shows a 'New consultation' window. On the left, under 'Tick to confirm that this is what you mean:', there is a list of concepts: 'Referred by another GP', 'Pain in finger' (with sub-items 'Index finger' and 'Left'), and 'Unable to grip' (with a dropdown arrow and 'properly' below it). The 'Unable to grip' item is highlighted in yellow. On the right, under 'Type your notes here:', there is a text input field containing 'referred by gp' and 'Pain in left index finger. [Unable to grip properly]'. The text 'Unable to grip properly' is enclosed in a dashed box, and a pencil icon is positioned to its left. At the bottom left is a 'No match found' button, and at the bottom right are 'OK' and 'Cancel' buttons.

Figure 8: System Matching the Concept: Unable to Grip

If the user clicks on a suggested match label, the system will display the associated free text below the list of matches, again with the special icon, as shown in Figure 9. This is in the same position as the additional text field in the single concept matching approach.

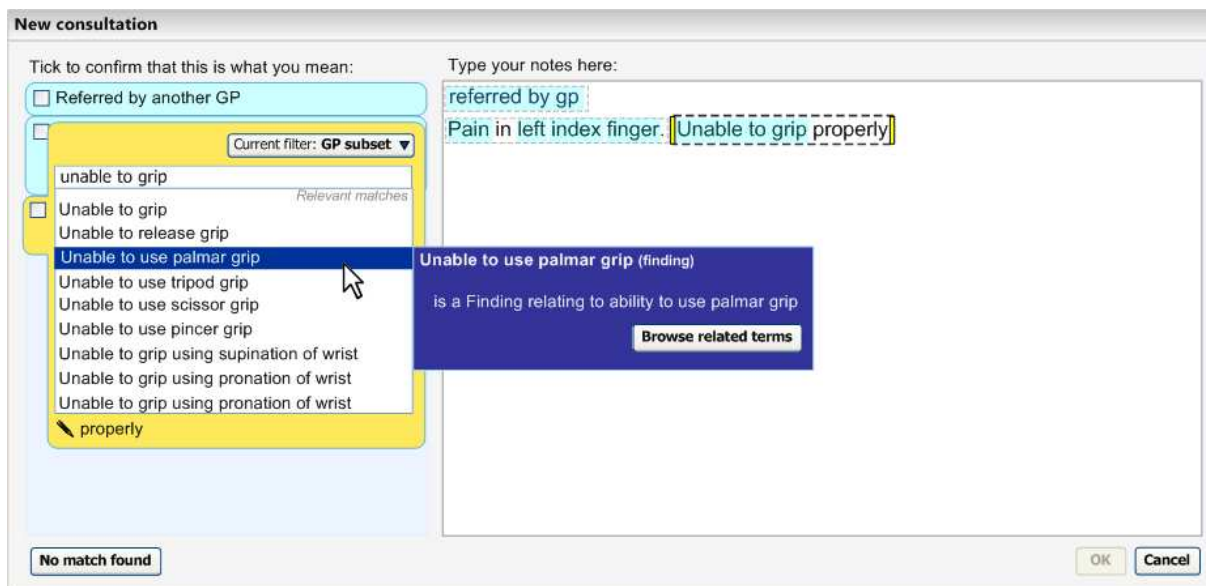


Figure 9: Clicking a Match Label to Use the Encoding Dialog

If the user does not want the free text to be associated with the SNOMED-CT expression, they can either delete the text from the note altogether or they can adjust the marquee boundaries by dragging the appropriate yellow handle with the mouse. As shown in Figure 10, when the user moves the mouse over one of the yellow marquee handles, two directional arrows appear on the handle to further communicate to the user that they can drag the handle. When the user has dragged the handle so that the marquee no longer contains the text 'properly', the text disappears from the suggested match area. The text 'properly' would then have its own marquee.

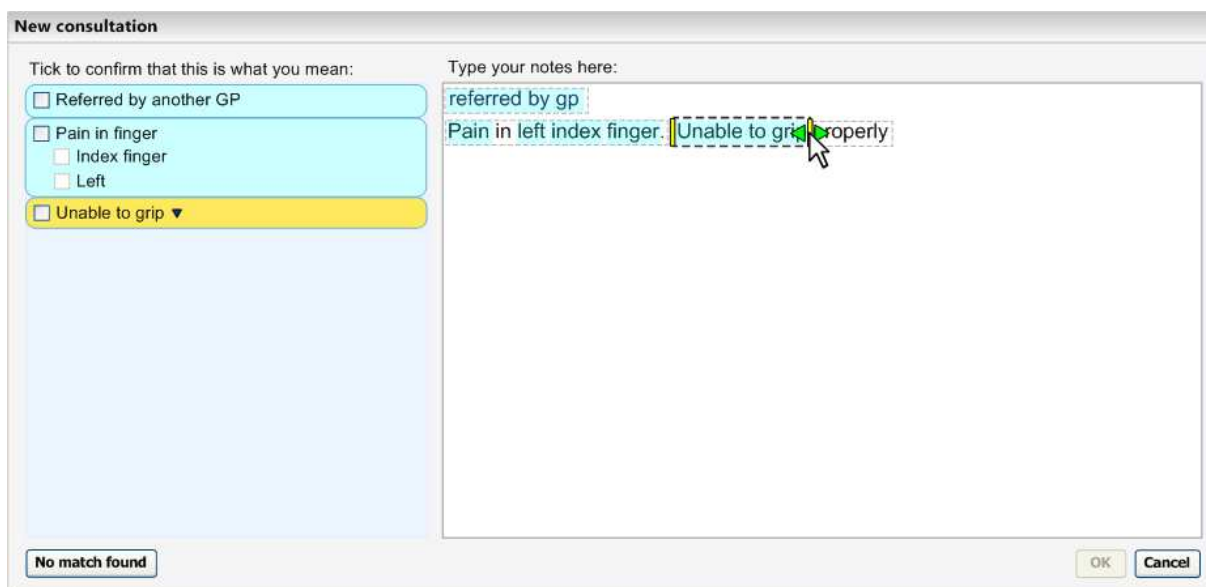


Figure 10: Adjusting the Expression Envelope (Marquee) Boundaries

Conversely, the user may also drag the boundary handles so that they include text that was not previously associated with a matched expression. The user, for example, may want to associate multiple sentences with a single matched expression.

2.1.2.1 **Guidance**

The system:

- Must allow the user to associate free text with SNOMED-CT expressions in the text parser approach to matching
- Must define 'free text' as any text that cannot be matched, either with a SNOMED-CT expression or another modelled expression (such as expressions of time or measurement readings)
- Must assume that free text is associated with a SNOMED-CT expression if it falls within the 'expression envelope', which itself is defined by (i) proximity, that is, if the text is immediately adjacent to the SNOMED-CT matched text, and by (ii) user-defined boundaries, such as full stops and carriage returns
- Should display the free text in the same area as the suggested match in the left-hand confirmation pane
 - Must distinguish the free text from the matched text
 - Could feature an icon to communicate that it is free text, rather than matched text
 - Could indent the free text and display it below the matched text, to show that the free text 'belongs' to the matched expression
- Should allow the user to read the free text while they are viewing the possible SNOMED-CT matches
 - Should display the free text below the list of possible SNOMED-CT matches
- Must allow the user to 'un-associate' the free text from the matched expression
 - Should allow the user to delete the free text
 - Should allow the user to manipulate the expression envelope boundaries, in order to move the free text outside of the expression envelope, and thus disassociate it from the matched expression
 - Should, conversely, allow the user to associate free text with a matched expression by manipulating the marquee boundaries, that is, dragging the boundaries so that they include text that was not already in the expression envelope

2.1.2.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Must feature an appropriate icon next to the free text in the suggested match area	We have shown a pencil icon, but we believe a better icon can be created	
✓	Provide an appropriate ToolTip that appears when the user moves the mouse over the handles of the marquee boundaries	Drag the handles to include or exclude text in the expression"	

Table 3: How to Use the Design Guidance

2.1.2.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	In the text parser approach to matching, allowing users to edit additional text anywhere but in the text input area	Providing an additional text field in the encoding dialog in the text parser approach.	In the text parser approach to matching, the user must only be able to edit additional text in one area, otherwise the interaction may become confusing.

Table 4: How Not to Use the Design Guidance

2.1.2.4 Benefits and Rationale

The approach outlined in this guidance is a very natural and unobtrusive way of allowing the user to associate free text elaboration with SNOMED-CT concepts. In fact, the user is doing what they would do anyway: writing their notes in sentences. As the sentences commonly define the expression envelopes and, in many cases, sentences are self-contained units of meaning, this approach does not require the user to do any unnatural action to associate this text (in most cases).

Where the user needs to associate free text that sits outside of the expression window, they must stretch the marquee around this additional text. Again, the notion of stretching a marquee around objects that one wants to include in the marquee is an intuitive action, akin to encircling notes that belong together. Clinicians confirmed that this approach is clear and understandable in usability testing. The mouse-over arrows (and ToolTip) reinforce the communication of this action.

However, there are a few open issues that remain with this parsing approach. For example, the clinician may enter a contextual modifier that applies to more than one expression, as in the note "Father has suffered heart failure. He also has arthritis". In this example, the modifier 'Father' should apply to both the expression of 'heart failure' and 'arthritis'. Under certain contextual headings (see *Design Guidance – Terminology – Matching {R1}* for details of contextual headings), the system could apply the modifier to all subsequent expressions until the user enters another modifier. Further rules may need to be developed and tested to overcome these specific issues.

2.1.2.5 *Confidence Level*

High

- Must allow the user to associate free text with SNOMED-CT expressions in the text parser approach to matching
- Must define 'free text' as any text that cannot be matched, either with a SNOMED-CT expression or another modelled expression (such as expressions of time or measurement readings)
- Should display the free text in the same area as the suggested match in the left-hand confirmation pane
- Must distinguish the free text from the matched text
- Could feature an icon to communicate that it is free text, rather than matched text
- Could indent the free text and display it below the matched text, to show that the free text 'belongs' to the matched expression
- Should allow the user to delete the free text

Medium

- Must assume that free text is associated with a SNOMED-CT expression if it falls within the 'expression envelope', which itself is defined by (i) proximity, that is, if the text is immediately adjacent to the SNOMED-CT matched text, and by (ii) user-defined boundaries, such as full stops and carriage returns
- Must allow the user to 'un-associate' the free text from the matched expression
- Should allow the user to manipulate the expression envelope boundaries, in order to move the free text outside of the expression envelope, and thus disassociate it from the matched expression
- Should, conversely, allow the user to associate free text with a matched expression by manipulating the marquee boundaries, that is, dragging the boundaries so that they include text that was not already in the expression envelope

Low

- Should allow the user to read the free text while they are viewing the possible SNOMED-CT matches
- Should display the free text below the list of possible SNOMED-CT matches

2.2 Elaboration with SNOMED-CT Attributes

The requirement for additional elaboration may arise because, on its own, the concept is missing some important qualification. For example, a diagnosis of 'gastroenteritis' could have different implications, depending upon the suspected severity of the disorder. The clinician may want to qualify this diagnosed disorder as being 'mild'. Likewise, the clinician may want to specify that a patient's asthma is 'on-going' rather than being a new episode.

As with other areas of the Terminology UI, the design primarily adopts a user-led approach. That is to say, the user gets what they enter. This principle applies for most qualifier attributes in this design. The user will only be offered matches for qualifier attributes that they have typed in themselves. This will apply to both the single concept matching approach and the text parser matching approach.

This document will focus on how the user may add qualifiers to a SNOMED-CT match using the single concept matching approach.

One exception to this 'user-led' principle of qualifier matching is when attributes are deemed 'mandatory', or are at least strongly recommended. A plausible example is laterality. This could apply to a body structure or a procedure that is defined in part by a body structure. In these situations, many clinical organisations will require the user to enter the laterality at the point of encoding. In this case, the system will actively offer the selection choices to the user, bearing in mind that 'Not specified' and 'Both' are both legitimate choices.

2.2.1 Matching SNOMED-CT Attributes Within Additional Free Text

In the single concept matching approach, the user may need to add structured qualification to a SNOMED-CT concept. This is especially important if the user is offered a field for free text entry, as there will be a temptation to qualify the matched concept with free text, and some of this free text qualification could be very important to the meaning of the note.

Therefore, the design matches attributes from within the free text, in a similar manner to the text parser approach. Unlike the text parser approach, the user can only enter one expression at a time, although the expression could comprise a SNOMED-CT concept plus multiple qualifiers.

In the example shown in Figure 11, the user has found matches for the word 'asthma' and selects the concept 'Asthma', by a single click. They then click in the additional text input field, and start typing some additional qualifying text.

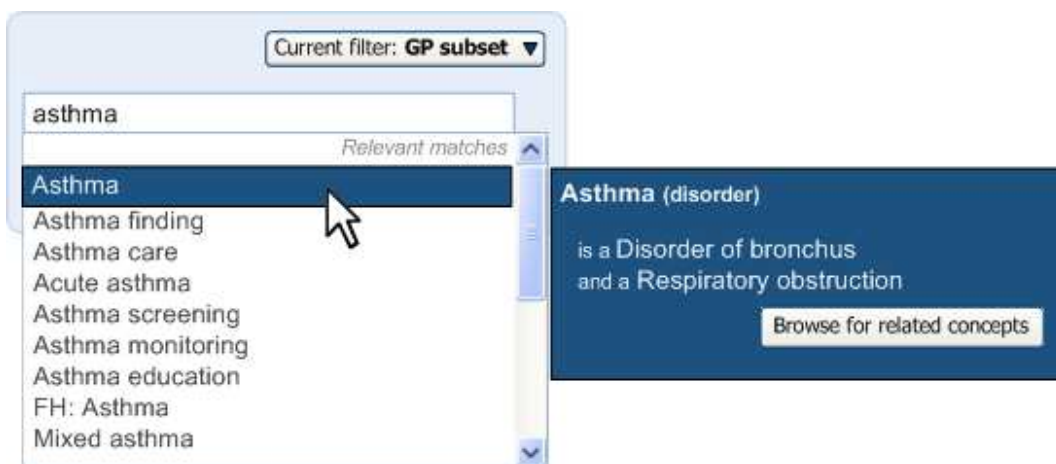


Figure 11: Selecting a SNOMED-CT Match Using a Single Click

As the user is typing in the additional text, the system is matching individual words (or strings of words) against SNOMED-CT attributes for the concept 'Asthma'. When it identifies a match, it highlights it in blue and displays the match above the additional text field, along with a check box for the user to confirm the match, as shown in Figure 12.

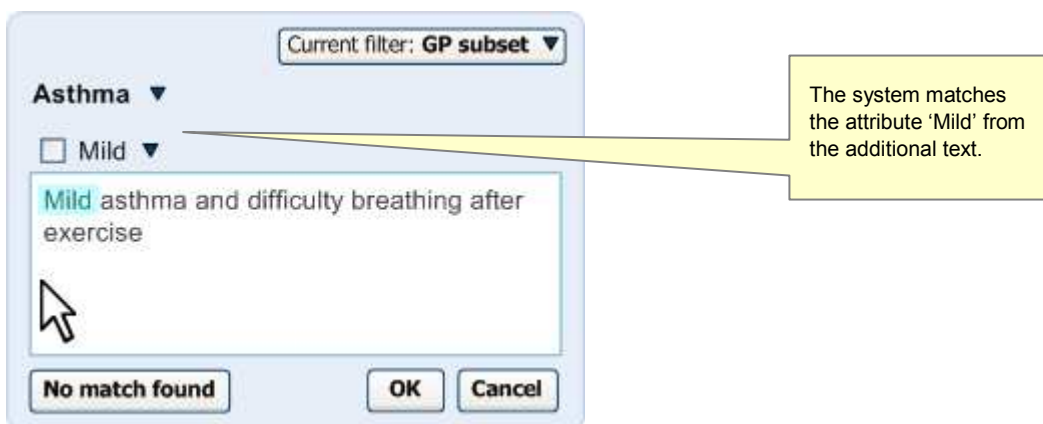


Figure 12: System Identifying a Match from Additional Qualifying Text

As the user moves the mouse over the label 'Mild', the area around it changes colour to signify that it is clickable, as shown in Figure 13.

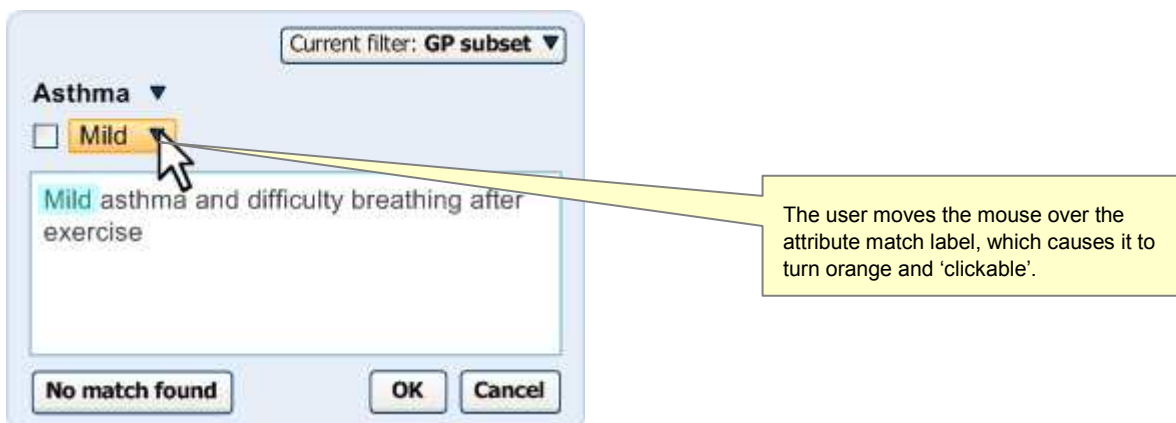


Figure 13: Label Changing Colour on Hover

The user clicks on the label to reveal other possible attribute matches for the word 'Mild', but decides that the top selection is the best match as shown in Figure 14.

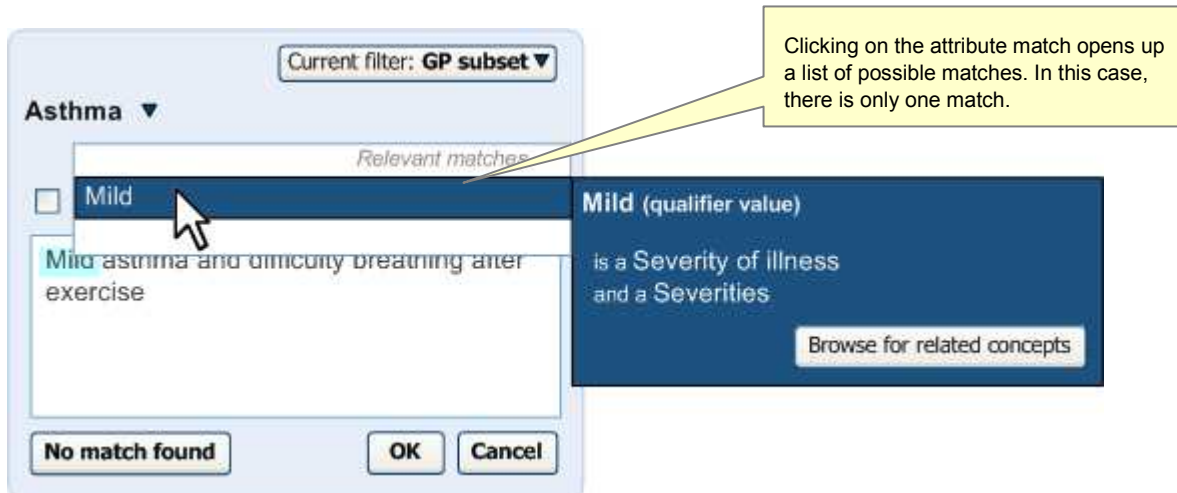


Figure 14: Displaying Possible Matches after Clicking on the Label

The user then selects the check box, and the attribute match becomes confirmed for encoding upon saving the note to record as shown in Figure 15.

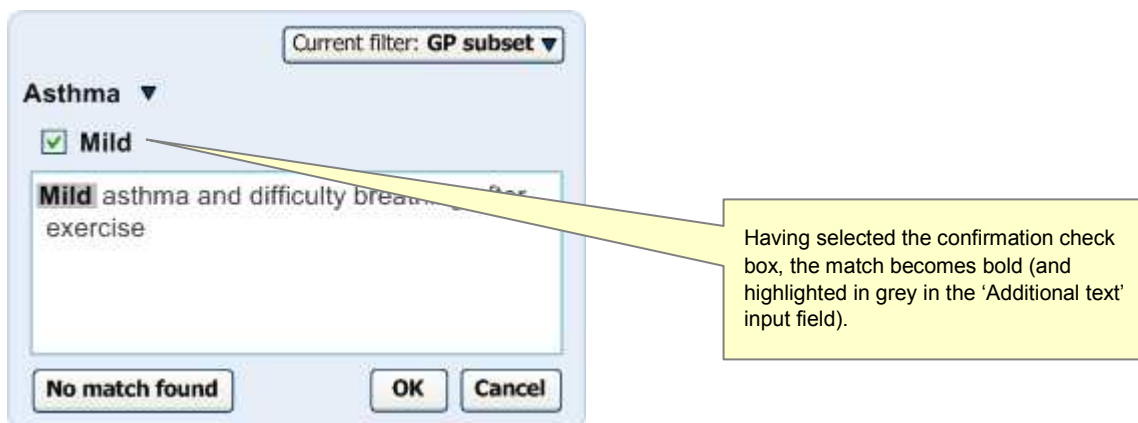


Figure 15: Additional Text after Selecting the Check Box

2.2.1.1 Guidance

The system:

- Must allow the user to type in notes that the system can match against SNOMED-CT matches that have attribute relationships with the selected SNOMED-CT concept, which are defined by the Concept Model (which specifies allowable relationships, including those in the Context Model) or an external information model.
- Should make the noting clear and efficient by using the same field for both the additional text and the input for attributes
- Should re-use the mechanisms for matching the text parser, namely: highlighting, bolding, featuring a confirmation check box, and featuring a control for viewing alternative matches

Note

Relationships needed for clinical noting are defined by an external information model which does not exist in the SCT, Concept or Context Models. An example would be the relationships between measurement values (that is, quantity and unit values) and the appropriate SNOMED-CT concepts.

2.2.1.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Allow the matching of multiple concepts, if they are all attributes of the base-concept	The system could match 'Severe' and 'Sudden onset' when the base-concept is 'Asthma'	
✓	Allow users to browse related concepts of an attribute	The user may wish to see what other levels of severity there are to choose from	

Table 5: How to Use the Design Guidance

2.2.1.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	Matching concepts that are not attributes of the base-concept (which is selected in the main list of matches)	Matching the concept 'Foot' if the user has selected the concept 'Fever' in the list above	

Table 6: How Not to Use the Design Guidance

2.2.1.4 Benefits and Rationale

This approach is a good example of the user-led principle of elaboration or, in other words, the user will type in what they want up-front.

Previous designs which featured a few elaboration settings displayed in drop-down list boxes in the flyout confused users who did not understand why these settings were being offered to them. They wondered why they were being offered selections for severity or episodicity, but not for other ways of adding description to the concept. Also, some users thought that they must select from the fields if they were being offered to them, which was incorrect and could lead to a lot of unnecessary encoding.

The display of lists of options that naturally belong in a logical order, but which are unordered in the SNOMED-CT database, can be confusing and misleading if they are left unordered. For example, in a list of severity ratings, the user would expect them to be arranged in a list of increasing or decreasing severity. However, the metadata to order these concepts in a meaningful way has not been created. The user-led approach removes the need for such metadata in this instance.

Consistent use of highlighting and matching labels with the text parser approach to matching will reduce the need for learning between the two approaches. The benefits and rationale for these mechanisms are covered in detail in the relevant sections of the following documents:

- *Design Guidance – Terminology – Matching {R1}*
- *Design Guidance – Terminology – Display Standards for Coded Information {R2}*

2.2.1.5 Confidence Level

Low

- Must allow the user to type in notes that the system can match against SNOMED-CT matches that have attribute relationships with the selected SNOMED-CT concept
 - Should make the noting clear and efficient by using the same field for both the additional text and the input for attributes
 - Should re-use the mechanisms for matching the text parser, namely: highlighting, bolding, featuring a confirmation check box, and featuring a control for viewing alternative matches

We have not tested the use of the additional text field in this way.

2.2.2 Warning of Important Unconfirmed Elaboration

If users are allowed to type in free text, the system must identify important words that can modify the meaning of the concept. If the user has typed in a word in the additional text field that is recognised to be an axis modifier, such as negation or a relation to the patient (meaning that the other family member is suffering from the disorder rather than the patient themselves), the system may offer this to the user in the same way as for the qualifier, namely with a highlight and a check box.

However, if the user fails to confirm the encoding of this axis modifier, the system should warn the user that they have not done so, and offer them a quick control to confirm it.

In the example shown in Figure 16, the user has typed that the patient's mother had asthma. The clinician could be trying to communicate that both the user and their mother have asthma, or they could mean that only the patient's mother is known to have asthma.

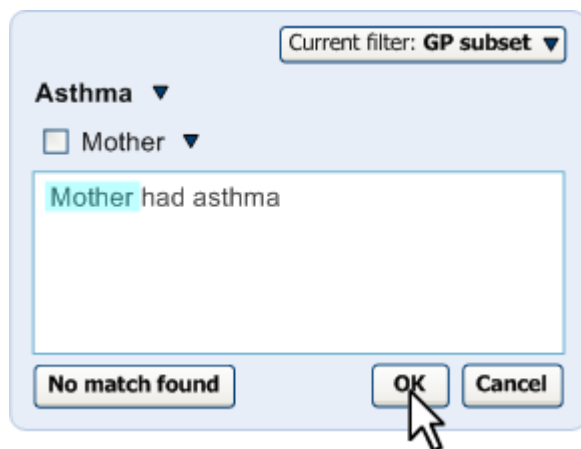


Figure 16: Presenting a Control for Confirming an Axis Modifier in Additional Text for Encoding

When the user tries to save the note by clicking 'OK', the system displays a warning, as shown in Figure 17, that they have not confirmed that it is the patient's mother and not necessarily the patient that has asthma. The system will offer the user the choice of confirming this or leaving the note as it is (which has the meaning that the patient has asthma and so does their mother).

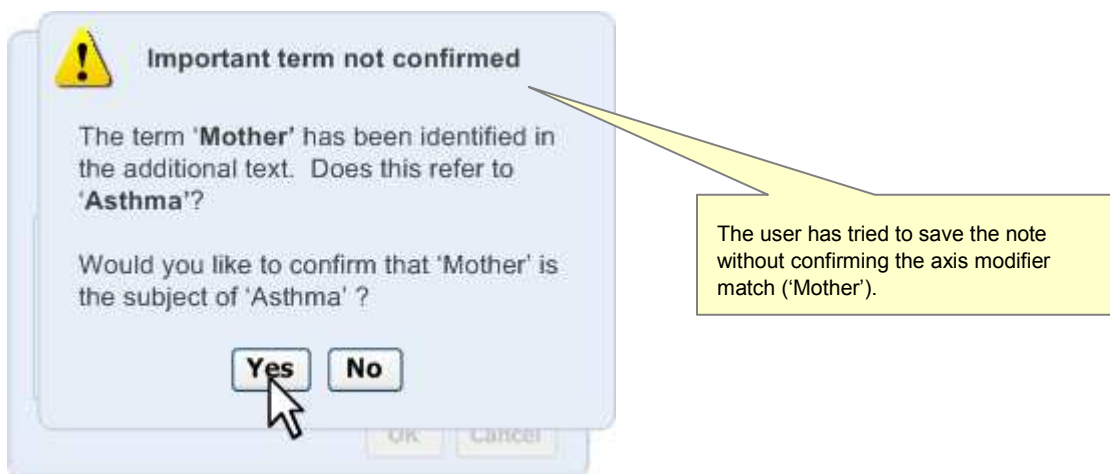


Figure 17: System Requesting Confirmation of Who Has Asthma

2.2.2.1 Guidance

The system:

- Must attempt to identify axis modifiers, such as negation, in the additional text notes and present them for confirmation in the same way as for the qualifier values
- Must warn the user if they try to save the note without confirming the axis modifier
- Should offer the user a quick control for confirming the axis modifier

Note

In order for this approach to work well, the high risk trigger words should be identified in SNOMED-CT itself.

2.2.2.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Clearly outline the problem and the way in which the user may resolve the problem	See text in Figure 17	

Table 7: How to Use the Design Guidance

2.2.2.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	Present the user with an array of options in the warning message.	Do not offer users the choice of 'Yes', 'No' and 'Cancel'	

Table 8: How Not to Use the Design Guidance

2.2.2.4 **Benefits and Rationale**

It is important to alert users to 'dangerous' elaboration words that the user may expect the system to act on (such as negation). The guidance outlined here allows the user flexibility to type in what they want, but forces them to attend to any critical elaboration. Words that match with axis modification concepts are particularly dangerous as they fundamentally change the meaning of the expression. Qualifier values do not need these warning messages.

The design allows the user to type in axis modifiers in the text entry fields, but will not present these modifiers (even the default 'soft' settings of these values) unless the user has typed them in. Previous designs featured a fly-out that displayed fields for axis modifier concept values, but users found them confusing. For example, featuring the text 'the patient currently has this finding' was not understood by clinicians.

2.2.2.5 **Confidence Level**

High

- Must warn the user if they try to save the note without confirming the axis modifier

Medium

- Must attempt to identify axis modifiers, such as negation, in the additional text notes and present them for confirmation in the same way as for the qualifier values
- Should offer the user a quick control for confirming the axis modifier

2.2.3 **Mandatory SNOMED-CT Qualification**

The guidance shows how some qualification could be communicated as mandatory by the user interface. The best example of this is laterality, that is, whether a body structure or a procedure or finding that is partly defined by a body structure is the left or right instance of that body structure. For example, if the user types in 'Fracture of radius', it will be important to know whether this refers to the patient's left radius, right radius or both. This has important implications for levels of patient safety.

In the example shown in Figure 18, the user has selected 'Fracture of radius' in the single concept matching approach.

The flyout for the concept contains a drop-down list from which the user must select the laterality of the radius, or state that they do not know which side the affected radius is on. The drop-down is coloured yellow to grab the user's attention, and the user cannot click 'OK' to save the note until they have selected a choice from the drop-down list.

Please note that if the user has typed laterality into the additional text field and has confirmed the match, the drop-down list box will disappear and the 'OK' will be enabled.

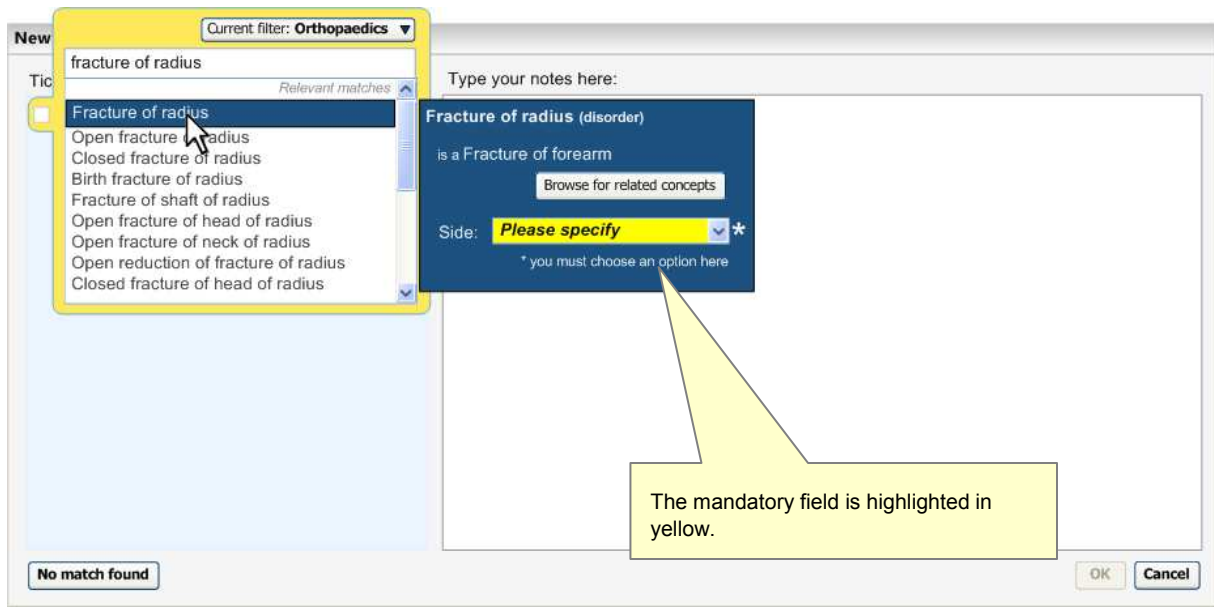


Figure 18: Example of a Mandatory Qualifier Field in the Single Concept Matching Approach

The implementation of mandatory qualifier fields also applies to the text parser approach. In the example shown in Figure 19, the user has typed in 'Fracture of radius' and the system has matched this with the SNOMED-CT concept 'Fracture of radius'. However, the system does not enable the check box for confirming the encoding of the phrase. Instead, when the user moves the mouse over the concept match area, the system displays a warning message, telling the user to specify whether the radius is on the left, right or both (or unknown).

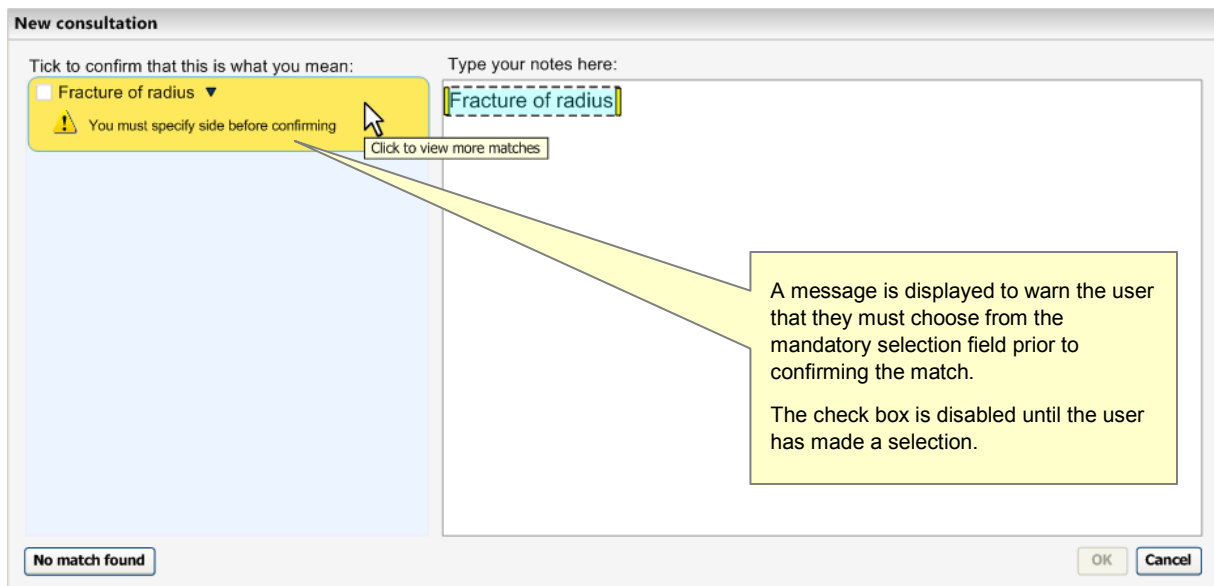


Figure 19: Concept that Requires a Statement of Laterality

At this point, the user could add the word 'left' (or 'right', or 'both') in the text input area. Alternatively, they could click on the match in the left-hand pane, which would reveal the qualifier drop-down list as illustrated in Figure 20.

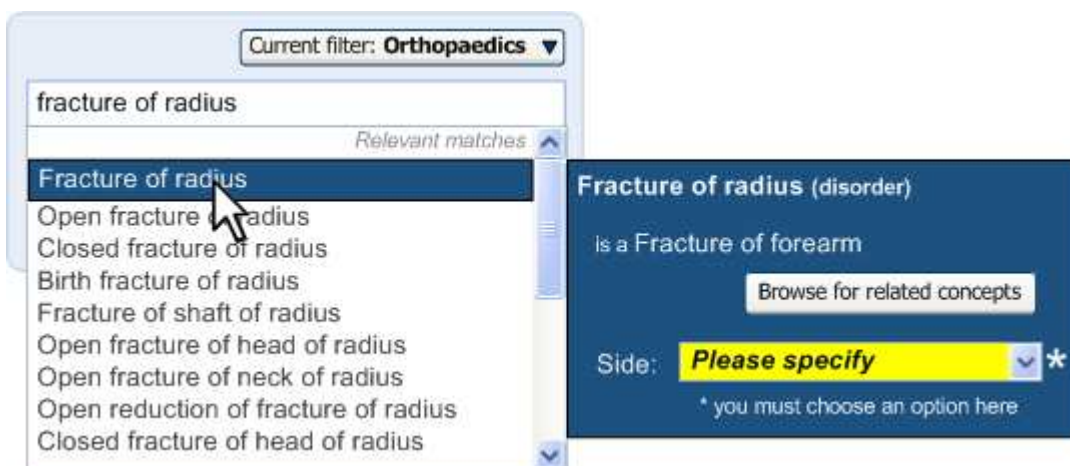


Figure 20: Displaying the Field for Selecting Laterality

Selecting the laterality from the list box enables the confirmation check box. Also, at this point, the background of the qualifier's drop-down turns from yellow to white as shown in Figure 21.

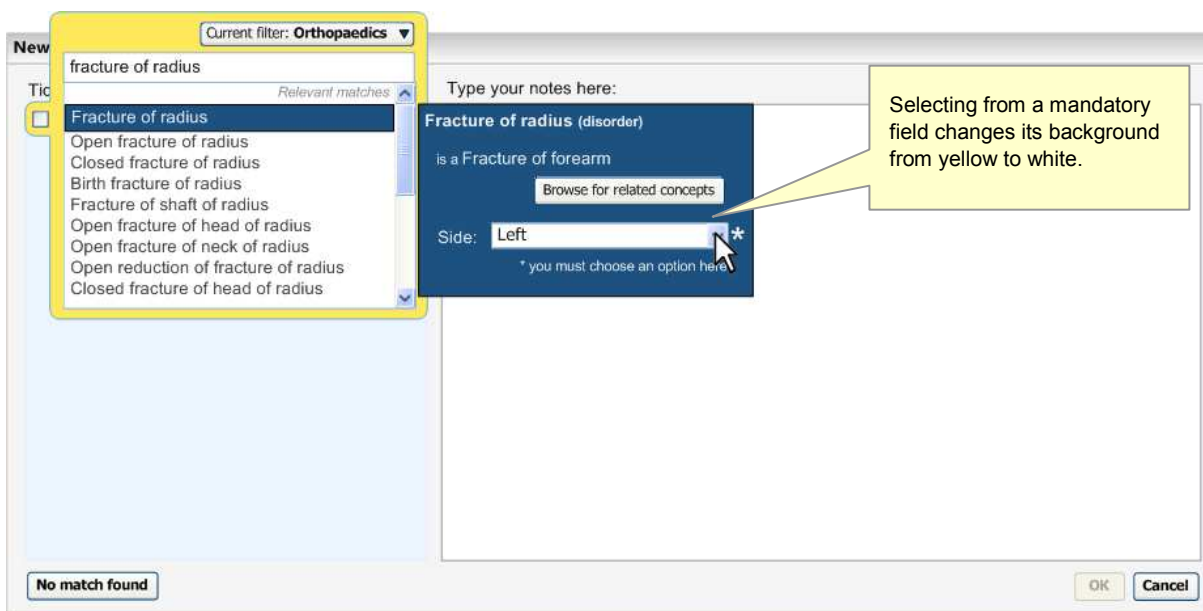


Figure 21: Selecting a Qualifier Value, Enabling the Confirmation Checkbox

Figure 22 shows that when the user confirms the match, the qualifier value is displayed in the match and is rendered in the text input area. Please note that the check box for the qualifier value is selected, but is disabled to prevent the user from removing the qualifier, but leaving the base concept confirmed. If the user wants to change the laterality setting, they must un-confirm the base concept (that is, 'Fracture of radius') before clicking on it and changing the setting in the match's flyout.

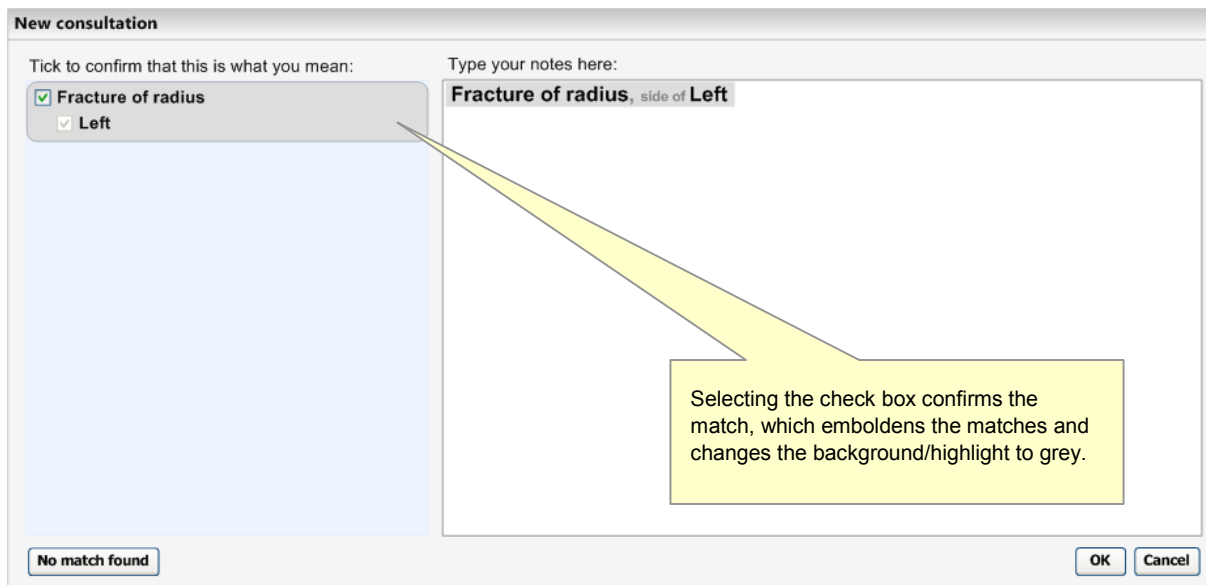


Figure 22: Confirmed Match with Qualifier

2.2.3.1 Guidance

The system:

- Must disable the control for confirming a match (text parser matching approach) or the control for saving the note (single concept matching approach) if there is a mandatory qualifier that remains unresolved
- Must provide a control for selecting the mandatory qualifier
 - Could feature a drop-down list box
 - Should associate the control with the individual match
 - Should feature the control in the match's flyout
- Must communicate to the user that they must select the mandatory qualifier in order to confirm/save the note
 - Should feature a warning message in the suggested match area (in the left-hand pane) that appears when the user moves the mouse over the area
 - Should feature the words 'Please specify' in the mandatory qualifier selection control
 - Should make the mandatory qualifier selection control sufficiently prominent
 - Could feature the mandatory qualifier selection control in yellow, until the user selects an option from it

- Must not allow the user to un-confirm the mandatory qualifier value independently from the base concept

Note

The identification of mandatory elaboration would imply the creation of appropriate metadata.

2.2.3.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Highlight the mandatory elaboration with a bright colour	See Figure 20	
✓	Provide a hover-over message that indicates that the field is mandatory	The message could read "You must select from this list to be able to encode ' <i>name of the concept</i> '"	
✓	Feature the text 'Please specify' within the initial view of the selection field	See Figure 20	
✓	Provide a key that communicates how mandatory fields are displayed	See Figure 20	

Table 9: How to Use the Design Guidance

2.2.3.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	Do not allow users to encode a term without selecting all its mandatory fields	n/a	

Table 10: How Not to Use the Design Guidance

2.2.3.4 Benefits and Rationale

Preventing users from encoding a concept without selecting a mandatory field forces the user to select it (if they want to encode the concept). A bright background in the mandatory field will grab the user's attention, and the asterisk icon with the key at the foot of the dialog would make it explicit that the field is mandatory. This asterisk and footnote will be more important if there are multiple fields in the flyout, for example, if there are values to enter

Another good place to communicate that there are mandatory fields for the user to complete is near to the confirmation control in the suggested matches area, as this area is also used to display warning messages about similar matches.

2.2.3.5 Confidence Level

High

- Must provide a control for selecting the mandatory qualifier
 - Could feature a drop-down list box
 - Should associate the control with the individual match
 - Should feature the control in the match's flyout
- Must not allow the user to un-confirm the mandatory qualifier value independently from the base concept
- Must communicate to the user that they must select the mandatory qualifier in order to confirm/save the note

Medium

- Must disable the control for confirming a match (text parser matching approach) or the control for saving the note (single concept matching approach) if there is a mandatory qualifier that remains unresolved
- Should feature the words 'Please specify' in the mandatory qualifier selection control
- Should make the mandatory qualifier selection control sufficiently prominent
 - Could feature the mandatory qualifier selection control in yellow, until the user selects an option from it

Low

- Should feature a warning message in the suggested match area (in the left-hand pane) that appears when the user moves the mouse over the area

2.3 Elaboration with Additional Values

There will be additional values that SNOMED-CT does not contain, but which will be crucial to creating a meaningful note. These may be time values, such as months, hours or dates (there are some codable dates in SNOMED-CT; the system would need to distinguish expressions of date that are codable in SNOMED-CT from those which are not); or values for an observable entity reading, such as temperature or blood pressure.

The system must be able to recognise these values and any specified units from within the user's typed notes, and where there are not appropriate units identified, the system must suggest an appropriate default unit. The relationships between the concepts and the value, plus the values themselves, must be taken from an external information model if they are not present in SNOMED-CT itself.

2.3.1 Identifying Values Within Text

It will be important for the clinician to be able to type numerical values into their notes, and for the system to recognise these values and to associate them with the correct concept. These values are not modelled in SNOMED-CT, and will be derived from an external information model, but the system must ensure that, from the user's point of view, the interaction appears seamless.

It is also important that the system can derive the appropriate measurement unit, based upon the numbers and the concept (SNOMED-CT or non-SNOMED-CT) with which they are associated. It is also crucial that the system can validate the numbers, for example, to avoid decimal points in the wrong place, or the user entering too few digits. We would expect to employ an information model that contained information about the formats and ranges of the measurement types covered.

The design will allow the user to type values into the text input area. In the example shown in Figure 23, the user types in a temperature of '39.8°C'. Meanwhile, the system has matched the text 'Temperature' with the SNOMED-CT observable entity concept, 'Body temperature'. Drawing from an appropriate information model, the system recognises that, for the concept of 'Body temperature', the figure '39.8' falls within a range that would imply that this was a measurement taken in degrees centigrade. In its match, therefore, the system adds the unit, '°C'. It also inserts the temperature value after the SNOMED-CT match, with an equals ('=') sign between concept and value.

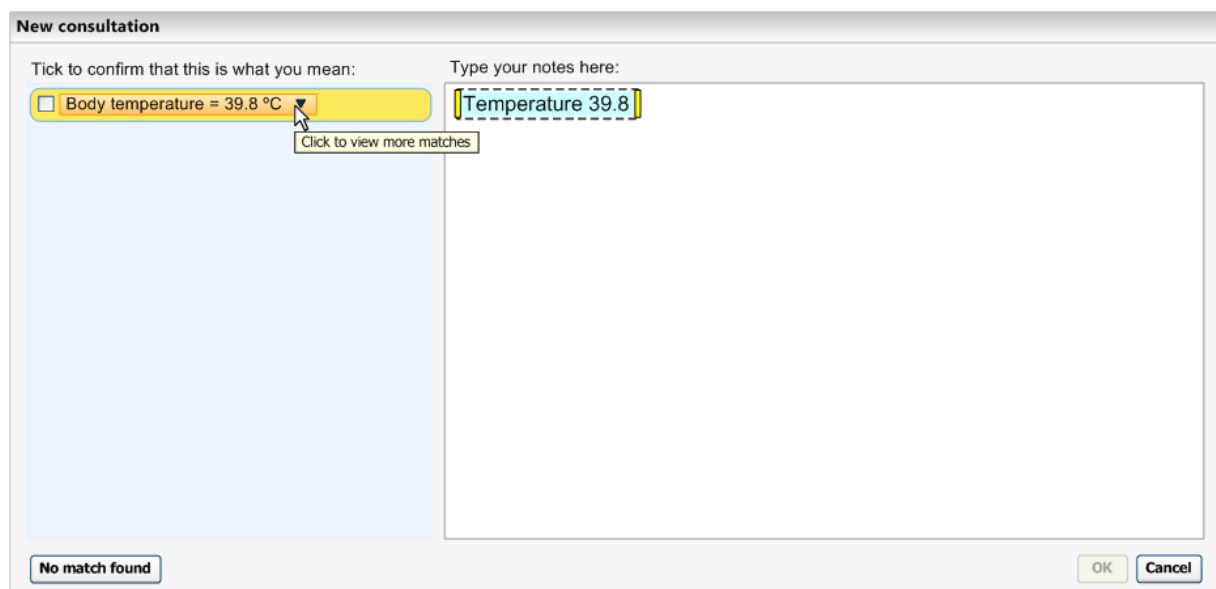


Figure 23: Entering Text that Contains Measurement Values

If the user expands the encoding dialog for the match, the system presents fields in the flyout for the value and the value's unit, pre-populated with '39.8' and '°C' respectively as shown in Figure 24. If the user were to change the figure or the unit, this would be reflected in the suggest match label in the left pane and, if the user confirmed the match, in the final rendered text.

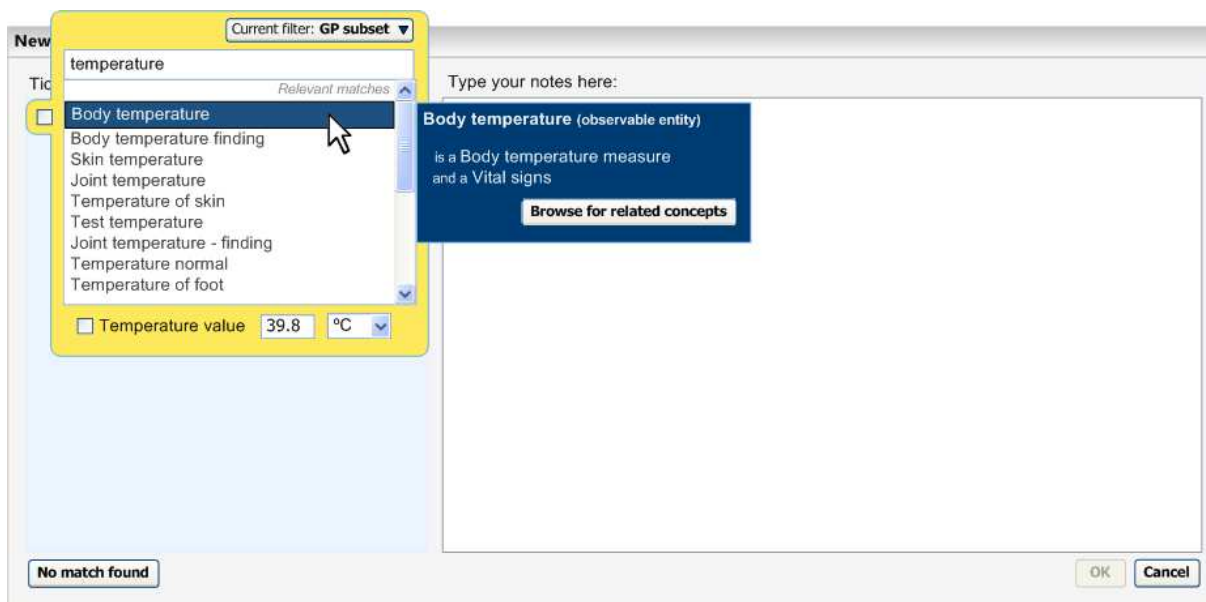


Figure 24: Selecting the Match to Display Value and Unit Fields in the Flyout

2.3.1.1 Guidance

The system:

- Must identify values and units from within the notes
- Should suggest default units for measurement values
- Must display the values and units it has identified back to the user for the user's confirmation
- Should allow the user to adjust the values and units in the expanded encoding dialog

Note

Quantity and unit values, and their relationships with appropriate SNOMED-CT concepts, in the main, will require additional information model data.

2.3.1.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Deduce the appropriate unit and display this with the value	See Figure 23	

Table 11: How to Use the Design Guidance

2.3.1.3 *How Not to Use the Design Guidance*

Usage	Format	Example	Comments
x	Interpret a full stop character as a full stop if it has digits immediately both sides of it.	39.8 should not be interpreted by the system as two sentences	

Table 12: How Not to Use the Design Guidance

2.3.1.4 *Benefits and Rationale*

This approach allows users to enter values as part of their typing in notes in a narrative format. In this way, the entry of values should not require additional actions to the typing of the user's text-based notes. However, the validation mechanism is important, and users should be warned if the values fall outside of recognised ranges or formats.

User testing has shown that users understand and accept this approach.

2.3.1.5 *Confidence Level*

High

- Must identify values and units from within the notes
- Must display the values and units it has identified back to the user for the user's confirmation

Medium

- Should allow the user to adjust the values and units in the expanded encoding dialog

2.3.2 *Templates*

In addition to the system identifying values and units from with the clinician's notes, the system should also encourage users to enter values in response to matching certain concepts that are associated with or require certain values.

In the example shown in Figure 25 (below), the user has selected the SNOMED-CT concept match 'Body temperature' within the single concept matching approach. The system identifies that this concept is associated with temperature readings, and that the default unit is degrees centigrade. It therefore presents two fields, one for value, the other for unit (which, in this case, is set by default to °C). The value field has a validation process triggered upon the focus leaving the field. Failure to meet the validation criteria will trigger an 'error' message which will tell the user to change the value if they wish to confirm the concept. For example, if the user types in 398 (instead of 39.8), the system would launch an error message, inviting the user to correct the figure.

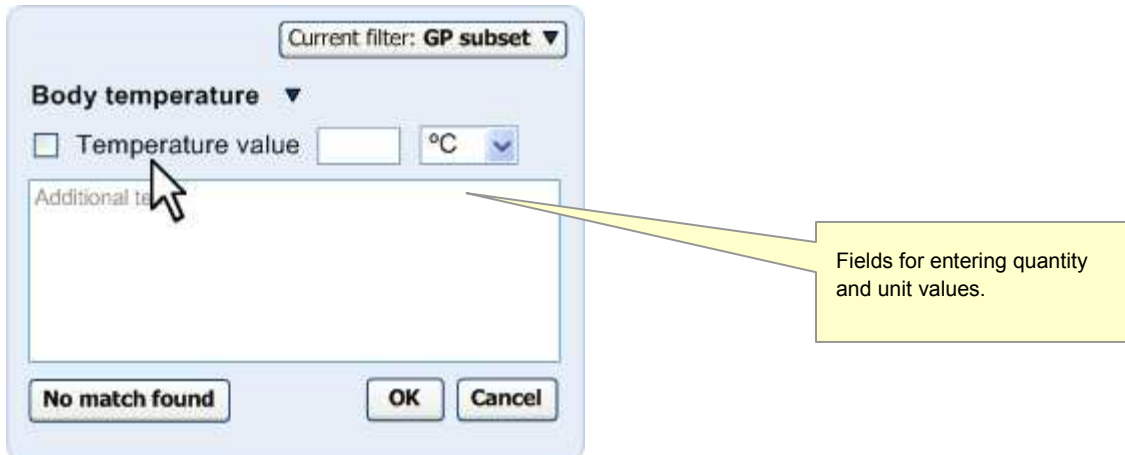


Figure 25: Displaying Fields in the Flyout for Entering Measurement Values

Typing a figure into the 'Temperature value' field will automatically select its confirmation check box. On the other hand, if the user selects the confirmation check box, but does not enter a value, the system will launch a warning message when the user clicks the 'OK' button.

Figure 26 (below) illustrates the text parser matching approach. The system identifies the match for 'Blood pressure' in the clinician's notes, and recognises it as an opportunity for the entry of values. The system tags the expression with a yellow mark in the lower right-hand corner of the marquee.

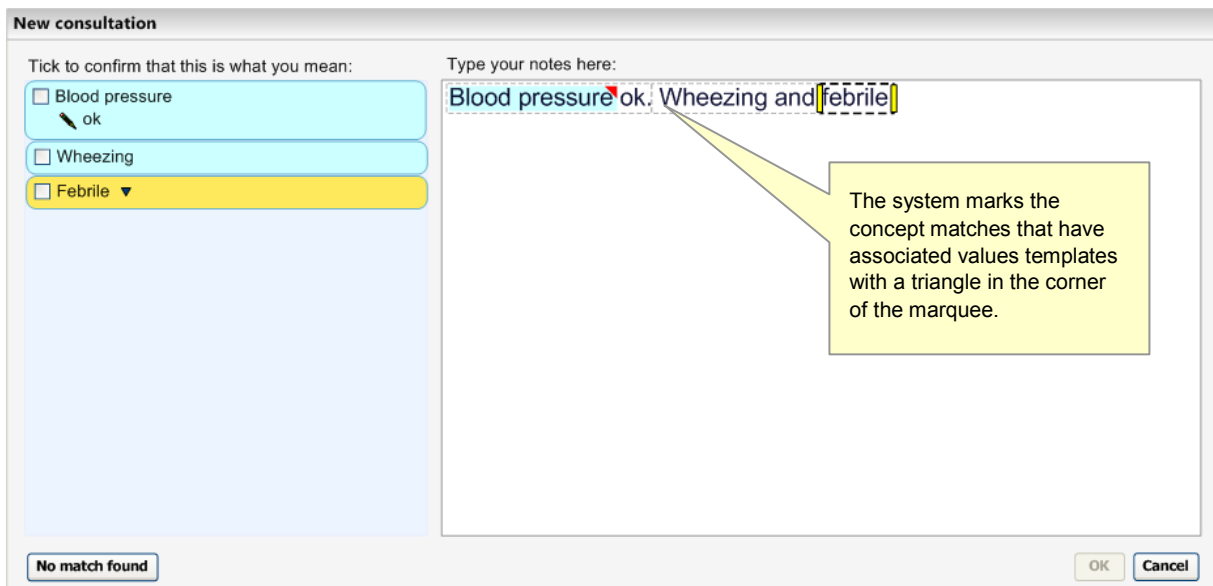


Figure 26: Identifying an Opportunity for Entry of Values

When the user moves the focus to the relevant expression, the system displays a floating dialog into which the user can enter blood pressure values, as shown in Figure 27 (below). Additionally, in the suggested match area (highlighted in yellow in the left-hand pane) the system displays a message encouraging the user to enter values for the blood pressure reading ('You should enter values'). At this point, if the user wishes to enter values, they have the choice of:

- Clicking on the match label ('Blood pressure') and entering the values into the encoding dialog flyout
- Entering the values into the floating dialog in the text input area (in the right-hand pane)
- Typing the values directly into the text input area

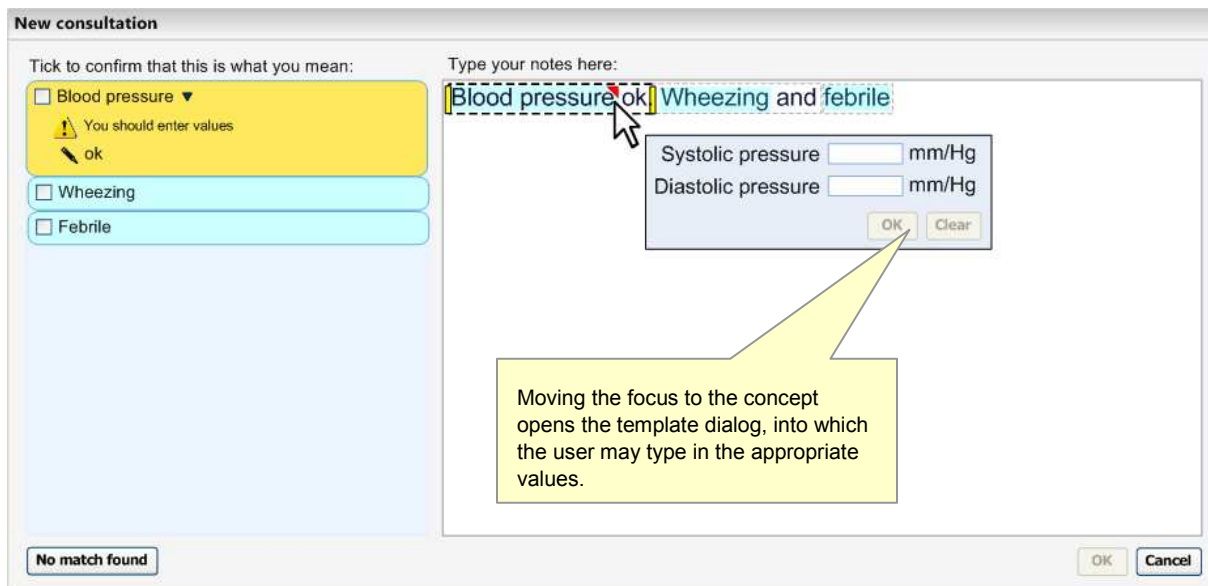


Figure 27: Dialog Box for Entering Values

The case of 'Blood pressure reading' also highlights an instance of a 'composite' expression, where multiple concepts are combined to form a single output unit. Real world concepts (for example, BP 120/80 mmHg) are often expressed quite differently in SNOMED-CT (in this case, as a combination of diastolic and systolic blood pressure). Although the atomic components of these relationships are found in SNOMED-CT, the relationships are not. Therefore, the relationships which create the composites may need to be modelled outside of SNOMED-CT, in an external information model.

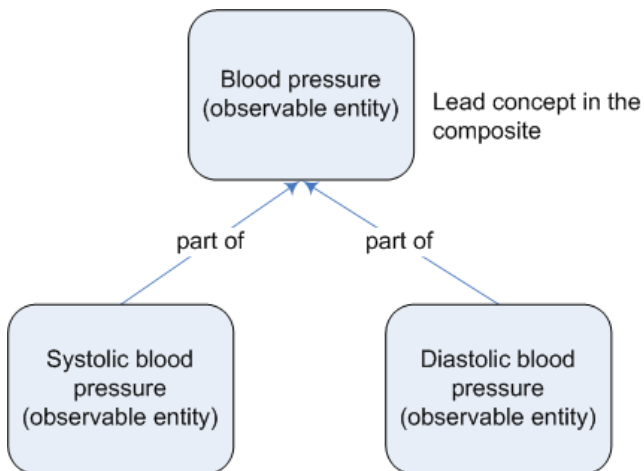


Figure 28: Example of a Composite of Three Concepts ('Blood Pressure Reading')

2.3.2.1 Guidance

The system:

- Should identify where matched concepts are associated with or require values
- Should encourage users to enter values where appropriate
 - Could provide fields into which users can enter these values
 - Could provide a process whereby it marks those expressions which could require values and display a floating dialog when the focus moves to these expressions
- Should pre-populate the template with any values it has identified during the text parsing process
- Should identify elements of composites and communicate them as a single composite (in addition to the individual elements), such as 'Blood pressure'
- Should be able to recognise composite values entered alongside a concept
- Should encourage users to enter in further values that comprise the composite by offering entry fields where appropriate

Note

- Quantity and unit values, and their relationships with appropriate SNOMED-CT concepts, in the main, will require additional information model data.
- Composites do not exist in the SNOMED-CT Concept Model. Expressing these relationships requires metadata.

2.3.2.2 How to Use the Design Guidance

Usage	Format	Example	Comments
✓	Offer default units	See Figure 27	

Table 13: How to Use the Design Guidance

2.3.2.3 How Not to Use the Design Guidance

Usage	Format	Example	Comments
✗	Offer default values	n/a	This could lead to the system encoding values that the user had not entered

Table 14: How Not to Use the Design Guidance

2.3.2.4 Benefits and Rationale

Offering appropriate entry fields for composite values could assist users in their workflow. Validation of the measurements should help to prevent errors, and is therefore important for patient safety. The system should offer the flexibility to the user of either typing the values into the main notes, or adding the values at the point of confirming the note (that is, in the expanded encoding dialog).

These templates have been presented to clinicians in usability tests, and clinicians have responded positively to them, saying that they understood what they are for and that they would be useful.

2.3.2.5 *Confidence Level*

High

- Should identify where matched concepts are associated with or require values
- Should encourage users to enter values where appropriate
 - Could provide fields into which users can enter these values

Medium

- Could provide a process whereby it marks those expressions which could require values and display a floating dialog when the focus moves to these expressions

3 DOCUMENT INFORMATION

3.1 Terms and Abbreviations

Abbreviation	Definition
FSN	Fully Specified Name
SCT	Systematised Nomenclature of Medicine-Clinical Terms
SNOMED-CT	Systematised Nomenclature of Medicine-Clinical Terms
UI	User Interface

Table 15: Terms and Abbreviations

3.2 Definitions

Term	Definition
Context Model	A model that specifies relationships relating to semantic context that has been defined outside of the SNOMED-CT Concept Model

Table 16: Definitions

3.3 Nomenclature

This section shows how to interpret the different styles used in this document to denote various types of information.

All content subject to completion, agreement or verification is denoted with **highlighting**.

3.3.1 Body Text

Text	Style
Code	Monospace
Script	
Other markup languages	
Interface dialog names	Bold
Field names	
Controls	
Folder names	Title Case
File names	

Table 17: Body Text Styles

3.3.2 Cross References

Reference	Style
Current document – sections	Section number only
Current document – figures/tables	Caption number only
Other project documents	<i>Italics</i> and possibly a footnote
Publicly available documents	<i>Italics</i> with a footnote
External Web-based content	<i>Italics</i> and a hyperlinked footnote

Table 18: Cross Reference Styles

3.4 References

Reference	Document	Version
R1.	Design Guidance – Terminology – Matching	1.0.0.0
R2.	Design Guidance – Terminology – Display Standards for Coded Information	1.0.0.0
R3.	SNOMED-CT: http://www.snomed.org/	

Table 19: References