ChatScript System Variables and Engine-defined Concepts

Revision 3/4/2017 cs7.3

- Engine-defined Concepts
- System Variables
- Control over Input
- Interchange Variables

Engine-defined concepts

In addition to concepts defined in script files, the system automatically defines a bunch of dictionary-based sets as well as dynamically computed concept members.

set	description
`~web_url`	word is a web url
`~email_url`	word is an email address
`~kindergarten`	word learned early in life
`~grade1_2`	word learned in these grades
`~grade3_4`	word learned in these grades

set	description
`~grade_5-6`	word learned in these grades. Unmarked words are learned even later
`~utf8`	word has nonascii characters
`~daynumber`	word could be a number of a day in a month
`~yearnumber`	word could be the number of a recent year
`~dateinfo`	phrase is month day year of some kind
`~kelvin`	temperature marker
`~celcius`	temperature marker
`~fahrenheit`	temperature marker

set	description
~twitter_name	twitter user name
~hashtag_label	twitter topic reference

Interjections, "discourse acts", and concept sets

Some words and phrases have interpretations based on whether they are at sentence start or not. E.g., *good day, mate* and *It is a good day* are different for *good day*.

Likewise sure and I am sure are different. Words that have a different meaning at the start of a sentence are commonly called interjections.

In ChatScript these are defined by the `livedata/interjections.txt` file. In addition, the file augments this concept with "discourse acts", phrases that are like an interjection. All interjections and discourse acts map to concept sets, which come thru as the user input instead of what they wrote. For example yes and sure and of course are all treated as meaning the discourse act of agreement in the interjections file. So you don't see yes, I will go coming out of the engine.

The interjections file will remap that to the sentence ~yes, breaking off that into its own sentence, followed by I will go as a new sentence.

These generic interjections (which are open to author control via interjections.txt) are: * `~yes` * `~no` * `~emomaybe` * `~emohello` * `~emogoodbye` * `~emohowzit` * `~emothanks` * `~emolaugh` * `~emohappy` * `~emosad` * `~emosurprise` * `~emomisunderstand` * `~emoskeptic` * `~emoignorance` * `~emobeg` * `~emobored` * `~emopain` * `~emoangry` * `~emocurse` * `~emodisgust` * `~emoprotest` * `~emoapology` * `~emomutual`

Because all interjections at the start of a sentence are broken off into their own sentence, this kind of pattern does not work:

```
u: (~yes _*)
```

You cannot capture the rest of the sentence here, because it will be part of the next sentence instead. This means interjections act somewhat differently from other concepts.

If you use a word in a pattern which may get remapped on input, the script compiler will issue a warning. Likely you should use the remapped name instead.

The following concepts are triggered by exactly repeating either the chatbot or oneself (to a repeat count of how often repeated). Repeats are within a recency

window of about 20 volleys. * `~repeatme` * `~repeatinput1` * `~repeatinput2` * `~repeatinput3` * `~repeatinput4` * `~repeatinput5` * `~repeatinput6`

POS (Part of Speech) Tags

Words will have pos-tags attached, specififying both generic and specific tag attributes, eg., * `~noun` * `~noun_singular`.

Generic Specifics

- `~noun`
- `~noun_singular`
- `~noun_plural`
- `~noun_proper_singular`
- `~noun_proper_plural`
- `~noun_gerund`
- `~noun_number`
- `~noun_infinitive`
- `~noun_omitted_adjective`
- `~verb`
- `~verb_present`
- `~verb_present_3ps`
- `~verb_infinitive`
- `~verb_present_participle`
- `~verb_past`
- `~verb_past_participle`
- `~aux_verb`
- `~aux_verb_present`
- `~aux_verb_past`
- `~aux_verb_future`
- `~aux_verb_tenses`
- `~aux_be`
- `~aux_have`
- `~aux_do`

Auxilliary verbs are segmented into normal ones and special ones. Normal ones give their tense directly. Special ones give their root word. The tense of the be/have/do verbs can be had via `^properties()` and testing for verb tenses

- `~adjective`
- `~adjective_normal`
- `~adjective_number`
- `~adjective_noun`
- `~adjective_participle`

Adjectives in comparative form will also have * `~more_form` or `~most_form`. * `~adverb` * `~adverb_normal`

Adverbs in comparative form will also have * `~more_form` or `~most_form` * `~pronoun`, `~pronoun_subject`, `~pronoun_object` * `~conjunction_bits`, `~conjunction_coordinate` , `~conjunction_subordinate` * `~determiner_bits`, `~determiner`, `~pronoun_possessive`, `~predeterminer` * `~possessive` (covers *'* and *'s* at end of word) * `~to_infinitive` ("to" when used before a noun infinitive) * `~preposition`, `~particle` (free-floating preposition tied to idiomatic verb) * `~comma` * `~quote` (covers *'* and _"_ when not embedded in a word) * `~paren` (covers opening and closing parens) * `~foreign_word` (some unknown word) * `~there_existential` (the word there used existentially)

In addition to normal generic kinds of pos tags, words which are serving a pos-tag role different from their putative word type are marked as members of the major tag they act as part of. E.g,

- `~noun_gerund` – verb used as a ~noun
- `~noun_infinitive` – verb used as a ~noun
- `~noun_omitted_adjective` – an adjective used as a collective noun (eg the beautiful are kind)
- `~adjectival_noun` (noun used as adjective like bank "bank teller")
- `~adjective_participle` (verb participle used as an adjective)

For `~noun_gerund` in *I like swimming* the verb gerund *swimming* is treated as a noun (hence called noun-gerund) but retains verb sense when matching keywords tagged with part-of-speech (i.e., it would match `swim~v` as well as `swim~n`).

- `~number` is not a part of speech, but is comprise of `~noun_number` (a normal number value like *17* or *seventeen*)
- `~adjective_number` (also a normal numeral value and also `~placenumber`) like first.

Additionally, there is * `~integer` * `~float` * `~positiveinteger` * `~negativeinteger` * `~modelnumber` (not a true number, but a word with both alpha and numeric)

To can be a preposition or it can be special. When used in the infinitive phrase To go, it is marked `~to_infinitive` and is followed by `~noun_infinitive`.

- `~verb_infinitive` refers to a match on the infinitive form of the verb (*I hear John sing* or *I will sing*).
- `~There_existential` refers to the use of where not involving location, meaning the existence of, as in There is no future.
- `~Particle` refers to a preposition piece of a compound verb idiom which allows being separated from the verb. If you say *I will call off the meeting*, call_off is the composite verb and is a single token. But if you split it as in *I will call the meeting off*, then there are two tokens. The original form

of the verb will be call and the canonical form of the verb will be call_off, while the free-standing off will be labeled `~particle`.

- `~verb_present` will be used for normal present verbs not in third person singular like *I walk* and
- `~verb_present_3ps` will be used for things like *he walks*
- `~possesive` refers to *'s* and *'* that indicate possession, while possessive pronouns get their own labeling `~pronoun_possessive`.
- `~pronoun_subject` is a pronoun used as a subject (like *he*) while
- `~pronoun_object` refers to objective form like *him*

Individual words serve roles in the parse of a sentence, which are retrievable. These include:

- `~mainsubject`
- `~mainverb`
- `~mainindirect`
- `~maindirect`
- `~subject2`
- `~verb2`
- `~indirectobject2`
- `~object2`
- `~subject_complement` – (adjective object of sentence involving linking verb),
- `~object_complement` – (2ndary noun or infinitive verb filling modifying mainobject or object2),
- `~conjunct_noun`, `~conjunct_verb`, `~conjunct_adjective`, `~conjunct_adverb`
- `~conjunct_phrase`, `~conjunct_clause`, `~conjunct_sentence`
- `~postnominalAdjective` - adjective occuring AFTER the noun it modified
- `~reflexive` - (reflexive pronouns)
- `~not`
- `~address` – noun used as addressee of sentence
- `~appositive` – noun restating and modifying prior noun
- `~absolutephrase` – special phrase describing whole sentence
- `~omittedtimeprep` – modified time word used as phrase but lacking preposition (*Next tuesday I will go*)
- `~phrase` – a prepositional phrase start (except
- `~clause` – a subordinate clause start |
- `~verbal` – a verb phrase |

System Variables

The system has some predefined variables which you can generally test and use but not normally assign to. These all begin with `%` . Ones that are reasonable to set are written in bold underline. Boolean values are always `1` or `null` on returns. `1` or `0` if you are setting them.

Date & Time & Numbers

variable	description
`%date`	one or two digit day of the month
`%day`	Sunday, etc
`%daynumber`	0-6 where 0 = Sunday
`%fulltime`	seconds representing the current time and date (Unix epoch time)
`%hour`	0-23
`%timenumbers`	completely consistent full time info in numbers that you can do `_0 = ^burst(%timenumbers)` to get `_0` =seconds (2digit) `_1`=minutes (2digit) `_2`=hours (2digit) `_3`=dayinweek(0-6 Sunday=0) `_4`=dateinmonth (1-31) `_5`=month(0-11 January=0) `_6`=year.You need to get it simultaneously if you want to do accurate things with current time, since retrieving %hour %minute separately allows time to change between calls
`%leapyear`	boolean if current year is a leap year
`%daylightsavings`	boolean if current within daylight savings
`%minute`	0-59
`%month`	1-12 (January = 1)
`%monthname`	January, etc
`%second`	0-59
`%volleytime`	number of seconds of computation since volley input started
`%time`	hh:mm in military 24-hour time
`%week`	1-5 (week of the month)
`%year`	e.g., 2011
`%rand`	get a random number from 1 to 100 inclusive

Time and date information are normally local, relative to the system clock of the machine CS is running on. See $cs_utcoffset for adjusting time based on relationship to utc (e.g your server is in Virginia and you are in Colorado).

User Input

variable	description
%bot	current bot responding
%revisedinput	Boolean is current input from ^input not direct from user
%command	Boolean was the user input a command
%foreign	Boolean is bulk of the sentence composed of foreign words
%impliedyou	Boolean was the user input having you as implied subject

variable	description
`%input`	the count of the number of volleys this user has made ever
`%ip`	ip address supplied
`%language`	current dictionary language
`%length`	the length in tokens of the current sentence
`%more`	Boolean is there another sentence after this
`%morequestion`	Boolean is there a ? or question word in the pending sentences

variable	description
`%originalinput`	all sentences user passed into volley, before adjusted in any way except OOB data is stripped off
`%originalsentence`	current sentence after tokenization but before any adjustments
`%parsed`	Boolean was current input parsed successfully
`%question`	Boolean was the user input a question – same as ? in a pattern

variable	description
%quotation	Boolean is current input a quotation
%sentence	Boolean does it seem like a sentence (subject/verb or command)
%tense	past , present, or future simple tense (present perfect is a past tense)
%user	user login name supplied
%userfirstline	value of %input that is at the start of this conversation start

variable	description
%userinput	Boolean is the current input from the user (vs the chatbot)
%voice	active or passive on current input

Chatbot Output

variable	description
%inputrejoinder	integer tag of any pending rejoinder for input or 0 if none
%lastoutput	the text of the last generated response for the current volley
%lastquestion	Boolean did last output end in a ?

variable	description
%outputrejoinder	rule tag if system set a rejoinder for its current output or 0
%response	number of responses that have been generated for this sentence

System variables

variable	description
%all	Boolean is the :all flag on? (:all to set)
%document	Boolean is :document running
%fact	Numeric value most recent fact id

variable	description
%freetext	kb of available text space
%freedict	number of unused dictionary words
%freefact	number of unused facts
%maxmatchvariables	highest number of match variables, currently 20
%maxfactsets	highest number of @fact-sets, currently 20
%host	name of the current host machine or "local"
%regression	Boolean is the regression flag on

variable	description
`%server`	Boolean is the system running in server mode
`%rule`	get a tag to the current executing rule. Can be used in place of a label

variable	description
`%topic`	name of the current "real" topic . if control is currently in a topic or called from a topic which is not system or nostay, then that is the topic. Otherwise the most recent pending topic is found
`%actualtopic`	literally the current topic being processed (system or not)

variable	description
`%trace`	Numeric value of the trace flag (:trace to set)
`%httpresponse`	return code of most recent ^jsonopen call
`%pid`	Linux process id or 0 for other systems
`%restart`	You can set and retrieve a value here across a system restart.
`%timeout`	Boolean tells if a timeout has happened, based on the time-limit command line parameter

Build data+

variable	description
%dict	date/time the dictionary was built
%engine	date/time the engine was compiled
%os	os invovled (linux windows mac ios)
%script	date/time build1 was compiled
%version	engine version number

You actually can assign to any of them. This will override them and make them return what you tell them to and is a particularly BAD thing to do if this is running on a server since it affects all users (unless you reset the variable at the end of the volley. Assigning a period to a variable resets it). Typically one does this as a temporary assignment in a #! comment line to set up conditions for testing using :verify. Making them return a new value is NOT the same thing as making the engine have a different value. Unless the variable is marked as settable, setting a value affects only the value returned by a future call to the system variable. It does not change engine values the variable is meant to reflect.

Control Over Input

The system can do a number of standard processing on user input, including spell correction, proper-name merging, expanding contractions etc. This is managed by setting the user variable $cs_token.

The default one that comes with Harry is:

```
$cs_token = #DO_INTERJECTION_SPLITTING |
            #DO_SUBSTITUTE_SYSTEM |
            #DO_NUMBER_MERGE |
            #DO_PROPERNAME_MERGE |
            #DO_SPELLCHECK |
            #DO_PARSE
```

The #signals a named constant from the dictionarySystem.h file. One can set the following:

These enable various LIVEDATA files to perform substitutions on input:

flag	description
`#DO_ESSENTIALS`	perform LIVEDATA/systemessentials which mostly strips off trailing punctuation and sets corresponding flags instead
`#DO_SUBSTITUTES`	perform LIVEDATA/substitutes
`#DO_CONTRACTIONS`	perform LIVEDATA/contractions, expanding contractions
`#DO_INTERJECTIONS`	perform LIVEDATA/interjections, changing phrases to interjections
`#DO_BRITISH`	perform LIVEDATA/british, respelling brit words to American

flag	description
`#DO_SPELLING`	performs the LIVE-DATA/spelling file (manual spell correction)
`#DO_TEXTING`	performs the LIVE-DATA/texting file (expand texting notation)
`#DO_SUBSTITUTE_SYSTEM`	all LIVE-DATA file expansions
`#DO_INTERJECTION_SPLITTING`	breaks off leading interjections into own sentence
`#$DO_NUMBER_MERGE`	merge multiple word numbers into one (*four and twenty*)

flag	description
`#$DO_PROPERNAME_MERGE`	Merge multiple proper name into one (_George Harrison)
`#DO_DATE_MERGE`	Merge month day and/or year sequences (*January 2, 1993*)
`#JSON_DIRECT_FROM_OOB`	Ask the tokenizer to directly process OOB data. See ^json-parse in JSON manual.

The contents of the files are pairs of tokens per line. Left is the word to replace and right is the replacement. When multiple words are involved, the left side uses underscores to represent this and the right side uses +. If the right side is missing, it means just delete.

If any of the above items affect the input, they will be echoed as values into %tokenFlags so you can detect they happened. The next changes do not echo into %tokenFlags and relate to grammar of input:

flag	description
DO_POSTAG	Allow pos-tagging (labels like ~noun ~verb become marked)
DO_PARSE	Allow parser (labels for word roles like ~main_subject)
DO_CONDITIONAL_POSTAG	Allow pos-tagging only if all words are known. Avoids wasting time on foreign sen-tences in particular

flag	description
NO_CONDITIONAL_IDIOM	Where a perform substitutions in the dictionary which are considered conditional idioms
NO_ERASE	Where a substitution would delete a word entirely as junk, don't

flag	description
DO_SPLIT_UNDERSCORES	Tapped after all other input tokenization and adjustments except number merge, and separates words that have been conjoined either because the dictionary has them (*credit_card*) or because they were merged by proper name merging, or by substitution. The result is only words without underscores (excluding number words like *five_thousand_and_four*)

flag	description
MARK_LOWER	If a word is considered a proper name in CS and is marked as an upper case word, this will force it to perform any markings for its lower case form as well. Sometimes users type stuff in upper case that really should be lower

Normally the system tries to outguess the user, who cannot be trusted to use correct punctuation or casing or spelling. These block that:

flag	description
STRICT_CASING	expect for 1st word of a sentence, assume user uses correct casing on words
NO_INFER_QUESTION	the system will not try to set the QUESTION-MARK flag if the user didn't input a ? and the structure of the input looks like a question
DO_SPELLCHECK	perform internal spell checking

flag	description
ONLY_LOWERCASE	Expect input (except "I") to be lower case, refuse to recognize upper-case forms of anything
NO_IMPERATIVE	
NO_WITHIN	
NO_SENTENCE_END	

Normally the tokenizer breaks apart some kinds of sentences into two. These prevent that:

flag	description
NO_COLON_END	Don't break apart a sentence after a colon
NO_SEMICOLON	Don't break apart a sentence after a semicolon

flag	description
`UNTOUCHED_INPUT`	this alone, will tokenize only on spaces, leaving everything but spacing untouched

flag	description
`LEAVE_QUOTE`	if input is found withing " " it will become a single token exactly as it is seen. W/o Leave_Quote, it is converted into a word without quotes and using underscores instead of spaces. So “My Fair Lady” becomes My_Fair_Lady, which would match a movie title if you had one, unlike *My Fair Lady* becoming the resulting token and unrecognized

flag	description

Note, you can change `$cs_token` on the fly and force input to be reanalyzed via `^retry(SENTENCE)`. I do this when I detect the user is trying to give his name, and many foreign names might be spell-corrected into something wrong and the user is unlikely to misspell his own name. Just remember to reset `$cs_token` back to normal after you are done. Here is one such way, assuming `$stdtoken` is set to your normal tokenflags in your bot definition outputmacro:

```
#! my name is Rogr
s: (name is _*)

    if ($cs_token == $stdtoken)
        {
        $cs_token = #DO_INTERJECTION_SPLITTING |
                    #DO_SUBSTITUTE_SYSTEM | #DO_NUMBER_MERGE |
                    #DO_PARSE
        retry(SENTENCE)
        }
    _0 is the name.
    $cs_token = $stdtoken
```

If you type *my name is Rogr* into a topic with this, the original input is spell-corrected to *my name is Roger*, but this will change the `$cs_token` over to one without spell correction and redo the sentence, which will now come back with *my name is Rogr* and be echoed correctly, and `$cs_token reset`. That's assuming nothing else would run differently and trap the response elsewhere. If you were worried about that, it would be possible for the script to save where it is using `^getrule(tag)` and modify your control script to return immediate control to here after input processing if you had changed `$cs_token`.

Private Substitutions

While in general, substitutions are defined in the LIVEDATA folder, you can define private substitutions for your specific bot using the scripting language. You can say

```
replace: xxx yyyyy
```

which defines a substitution just like a livedata substitution file. It actually creates a substitution file called `private0.txt` or `private1.txt` in your TOPIC folder. Even then, those substitutions will not be enacted unless you explicitly add to the $cs_token value #DO_PRIVATE, eg

```
$cs_token = #DO_INTERJECTION_SPLITTING |
            #DO_SUBSTITUTE_SYSTEM |
```

```
#DO_NUMBER_MERGE |
#DO_PROPERNAME_MERGE |
#DO_SPELLCHECK |
#DO_PARSE |
#DO_PRIVATE
```

The left side of the substitution pair is case insensitive (matches either case on input) and can be placed in double-quotes (which converts spaces to underscorers).

Similarly while canonical values of words can be defined in `LIVEDATA/SYSTEM/canonical.txt`, you can define private canonical values for your bots by using the scripting language. You can say:

```
canon: oh 0 faster fast
```

which defines new canonical values for things and creates a file canon0.txt or canon1.txt in your TOPIC folder. If you want to set a canonical pair from a table during compilation, you can use a function to do the same thing (but only 1 pair at a time).

```
^canon(word canonicalform)
```

Interchange Variables

The following variables can be defined in a script and the engine will react to their contents.

interchange variable	description
`$cs_token`	described extensively above

interchange variable	description
$cs_response	controls automatic handling of outputs to user. By default it consists of $cs_response = #Response_upperstart | #response_removespacebeforecomma | #response_alterunderscores | #response_removetilde If you want none of theses, use $cs_response = 0 (all flags turned off). See ^print for explanation of flags. #response_noconvertspecial – leave escaped n r and t alone in output and ^log, #response_upperstart – makes the first letter of an output sentence

interchange variable	description
`$cs_jsontimeout`	seconds before JsonOpen declares a time out failure. If unspecified the default is 300
`$cs_crashmsg`	in server mode, what to say if the server crashes and we return a message to the user. By default the message is *Hey, sorry. I forgot what I was thinking about.*
`$cs_abstract`	used with :abstract

interchange variable	description
`$cs_looplimit`	loop() defaults to 1000 iterations before stopping. You can change this default with this

interchange variable	description
`$cs_trace`	if this variable is defined, then whenever the user's volley is finished, the value of this variable is set to that of :trace and :trace is cleared to 0, but when the user is read back in, the :trace is set to this value. For a server, this means you can perform tracing on a user w/o making all user transactions dump trace data

interchange variable	description
`$cs_control_pre`	name of topic to run in gambit mode on pre-pass, set by author. Runs before any sentences of the input volley are analyzed. Good for setting up initial values
`$cs_usermessagelimit`	max number of message pairs (user input & bot output) saved in topic file

interchange variable	description
`$cs_externaltag`	name of a topic to use to replace existing internal English pos-parser. See bottom of ChatScript PosParser manual for details

interchange variable	description
`$cs_prepass`	name of a topic to run in responder mode on main volleys, which runs before $cs_control_main and after all of the above and pos-parsing is done. Used to amend prepa-ration data coming from the engine. You can use it to add your own spin on input process-ing before going to your main control. I use it to, for exam-ple, label com-mands as ques-tions, stan-

interchange variable	description
`$cs_control_main`	name of topic to run in responder mode on main volleys, set by author
`$cs_control_post`	name of topic to run in gambit mode on postpass, set by author
`$botprompt`	message for console window to label bot output
`$userprompt`	message for console window to label user input line
`$cs_crashmsg`	message to use if a server crash occurs

interchange variable	description
`$cs_language`	if spanish, will adjust spell checking for spanish colloquial
`$cs_token`	bits controlling how the tokenizer works. By default when null, you get all bits assumed on. The possible values are in src/dictionarySystem.h (hunt for $token) and you put a # in front of them to generate that named numeric constant

interchange variable	description
`$cs_abstract`	topic used by :abstract to display facts if you want them displayed
`$cs_prepass`	topic used between parsing and running user control script. Useful to supplement parsing, setting the question value, and revising input idioms

interchange variable	description
`$cs_wildcardseparator`	when a match variable covers multiple words, what should separate them- by default it's a space, but underscore is handy too. Initial system character is space, creating fidelity with what was typed. Useful if _ can be recognized in input (web addresses). Changing to _ is consistent with multiword representation and keyword recogni-

interchange variable	description
`$cs_userfactlimit`	how many of the most recent permanent facts created by the script in response to user inputs are kept for each user. Std default is 100
`$cs_response`	controls some characteristics of how responses are formatted
`$cs_randIndex`	the random seed for this volley

interchange variable	description
`$cs_utcoffset`	if defined, then %time returns current utc time + time-zone offset. The offset is usually a simple number, meaning hours, and can have + or – in front of it. It can also be a normal time reference like 02:30 which means plus 2 hours and 30 minutes beyond utc, or -01:30:20 which means 1 hour, 30 minutes, and 20 seconds before utc (as if anyone would

interchange variable	description
`$$db_error`	error message from a postgres failure
	$$findtext_start - ^findtext return the end normally, this is where it puts the start
`$$tcpopen_error`	error message from a tcpopen error
`$$document`	name of the document being read in document mode
`$cs_randindex`	current value of the random generator value

interchange variable	description
`$cs_bot`	name of the bot currently in use
`$cs_login`	login name of the user
`$$csmatch_start`	start of found words from ^match
`$$csmatch_end`	end of found words from ^match

interchange variable	description
`cs_botid`	when non-zero creates facts and functions restricted by this bit-mask so facts and functions created by other masks cannot be seen. allows you to separate facts and functions per bot in a multi-bot environment. During compilation if this is set by a bot: command, then functions created and facts created by tables

interchange variable	description