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Extended Indexical Hybrid Logic for Demonstratives

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In this research, we rewrite the Indexical Hybrid Logic for Tenses proposed by Blackburn (2012), as a description logic with agent as domain, and extend it to handle the pure indexical *I* of classification by Kaplan together with *He*, *She*.

Sentences and conversations including indexicals such as *I*, *Now*, *He*, etc., are difficult to determine as being true or false unless the context of the target indicated by the indices is clarified. In our framework, by deciding the speaker *I* (viewpoint) according to the context of the sentence, the identity of *He* or *She* can be determined. In Montague's theory (1960) for index indicators since the truth value changes relative to the index (index), the sentence "*It is raining now.*" becomes invalid. The word indicator was introduced by Kaplan (1977) and he categorized indexers in terms of pointing. We cannot identify by *He* and *She* exactly unless pointing is done. On the other hand, *I*, *Now*, *Tomorrow*, etc. are uniquely specified according to the utterance. When considering a sentence such as "*I am here now*", it is true as long as it is spoken only by the inclusive meaning of a pure index, but it is inappropriate in the Montague (1960) theory. So Kaplan (1977) claimed the necessity of two kinds of valuation, that is, the contextual validity that is true as long as it is uttered, distinguished from the logical validity (e.g. *Either it is raining or it is not*).

In response to Kaplan's theory, two-dimensional semantics that expresses two semantic values, we propose a variation of Hybrid Logic including contextual validity on the pure indicator *Now* in Blackburn's Tense. In the semantics of Blackburn, the function η is defined as a function from the inclusive meaning of a pure index to the extension and returns the point in time when the context is assigned to *Now*. Thus, the logical validity is defined to be true for any Kripke model, in an arbitrary context and time point, and the contextual validity is defined as an arbitrary Kripke model, true in any context. Thus, η can express the contextual validity of pure index *Now* by returning the point in time assigned to *Now* for any context. In this way, the logical validity and the contextual validity are distinguished.

The new point of this research is extending Hybrid Logic to Blackburn's tense as a description logic with individuals as domains, expressing the contextual validity of pure index *I*, and

specification of *He* and *She* from the viewpoint of *I*. It is possible to explain by using the assignment function g that points the destination for *He* or *She* for each viewpoint, *I*. This system is verified by the tableau method, but it is different from that of Blackburn et al. This is because it is easier to intuitively understand the correspondence with two-dimensional semantics constructed by the labeled logical expressions with two arguments. Moreover, for the newly constructed tableau method in this research, we independently demonstrated soundness and completeness.

In addition, this research expanded the relationship with the anaphoric analysis in linguistics such as DRT of Kamp & Reyle (1993) and the centering theory of Grosz (1994) on the function η in Blackburn's logic and the assignment function g added to the model in this research. For this purpose, this research also described what part of our logic can be incorporated into these analyses. In conclusion, this research will explain several problems of various historical directives, and consider whether the proposed logic can be expanded to those problems as well.