Hyperintensions as abstract procedures

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Abstract.

Hyperintensions are defined in my background theory Transparent Intensional Logic (TIL) as abstract procedures that are encoded by natural-language terms. For rigorous definition of a hyperintensional context it is crucial to distinguish two basic modes in which a given procedure can occur, namely *displayed* and *executed.* When a procedure *C* occurs displayed, then *C* itself figures as an object on which other procedures operate; while if *C* occurs executed, then the product of *C* figures as an object to operate on. Procedures are structured wholes consisting of unambiguously determined parts, which are those sub-procedures that occur in execution mode. They are not mere set-theoretic aggregates of their parts, because constituents of a molecular procedure *interact* in the process of producing an object. Furthermore, this part-whole relation is a partial order. On the other hand, the mereology of abstract procedures is non-classical, because the principles of extensionality and idempotence do not hold.

A hyperintensional context is the context of a displayed procedure, and it is easy to block various invalid inferences, because different procedures can produce one and the same function-in-extension, be it mathematical mapping or PWS-intension. But blocking invalid inferences in hyperintensional contexts is just the starting point. There is the other side of the coin, which is the *positive* topic of which inferences *should be validated* and how these valid inferences should be proved. The problem is this. A displayed procedure is a *closed* object that is not amenable to logical operations. To solve this technical difficulty, we have developed a *substitution method* that makes it possible to operate on displayed procedures within and inside a hyperintensional context. Having defined the substitution method makes it possible to specify β-conversion by 'value'. I am going to prove that unlike β-conversion by name this conversion is validly applicable so that the redex and contractum are logically equivalent. However, though TIL is a typed λ-calculus, the Church-Rosser theorem is not valid for β-reduction by name, which is so due to hyperintensional contexts. Hence, I am going to specify a fragment of TIL for which the theorem is valid. On the other hand, the Church-Rosser theorem is valid for β-reduction by value. Yet, in this case the problem has been postponed to the evaluation phase and concerns the choice of a proper evaluation strategy. To this end we have implemented the algorithm of context recognition that makes it possible to evaluate β-conversion by value in a proper way so that the Church-Rosser Theorem is valid in all kinds of a context. There are still other open issues concerning metatheory of TIL; one of them is the problem of completeness. Being a hyperintensional λ-calculus based on the ramified theory of types, TIL is an incomplete system in Gödel's sense, of course. Yet, I am going to specify a fragment of TIL that is complete in a Henkin-like way.