

```
(*****  
(* ProgrammingLanguageFlattening *)  
*****)
```

Generalizable All Variables.

```
Require Import Preamble.  
Require Import General.  
Require Import Categories_ch1_3.  
Require Import InitialTerminal_ch2_2.  
Require Import Functors_ch1_4.  
Require Import Isomorphisms_ch1_5.  
Require Import ProductCategories_ch1_6_1.  
Require Import OppositeCategories_ch1_6_2.  
Require Import Enrichment_ch2_8.  
Require Import Subcategories_ch7_1.  
Require Import NaturalTransformations_ch7_4.  
Require Import NaturalIsomorphisms_ch7_5.  
Require Import BinoidalCategories.  
Require Import PreMonoidalCategories.  
Require Import MonoidalCategories_ch7_8.  
Require Import Coherence_ch7_8.  
Require Import Enrichment_ch2_8.  
Require Import RepresentableStructure_ch7_2.  
Require Import FunctorCategories_ch7_7.
```

```
Require Import Reification.  
Require Import NaturalDeduction.  
Require Import NaturalDeductionCategory.  
Require Import GeneralizedArrow.  
Require Import ProgrammingLanguage.  
Require Import ProgrammingLanguageReification.  
Require Import SectionRetract_ch2_4.  
Require Import GeneralizedArrowFromReification.  
Require Import Enrichments.  
Require Import ReificationsAndGeneralizedArrows.
```

Section Flattening.

```
Context '(Guest:ProgrammingLanguage) '(Host :ProgrammingLanguage).  
Context (GuestHost:TwoLevelLanguage Guest Host).
```

```

Definition FlatObject (x:TypesL Host) :=
  forall y1 y2, not ((reification_r_obj GuestHost y1 y2)=x).

Instance FlatSubCategory : FullSubcategory (TypesL Host) FlatObject.

Context (F:RetractionOfCategories (TypesL Host) (FullSubCategoriesAreCategories FlatSubCategory)).

Definition FlatteningOfReification HostMonic HostMonoidal :=
  (garrow_functor
   (@garrow_from_reification
    (TypesEnrichedInJudgments Guest)
    (TypesEnrichedInJudgments Host)
    HostMonic HostMonoidal GuestHost))
  >>>> F.

Lemma FlatteningIsNotDestructive HostMonic HostMonoidal :
  FlatteningOfReification HostMonic HostMonoidal >>>> retraction_retraction F >>>> HomFunctor _ []
  ≃ (reification_rstar GuestHost).
  apply if_inv.
  set (@roundtrip_reification_to_reification (TypesEnrichedInJudgments Guest) (TypesEnrichedInJudgments Host)
    HostMonic HostMonoidal GuestHost) as q.
  unfold mf_F in *; simpl in *.
  eapply if_comp.
  apply q.
  clear q.
  unfold mf_F; simpl.
  unfold pmon_I.
  apply (if_respects
    (garrow_functor (TypesEnrichedInJudgments Guest) HostMonic HostMonoidal GuestHost)
    (FlatteningOfReification HostMonic HostMonoidal >>>> retraction_retraction F)
    (HomFunctor (TypesL Host) []))
    (HomFunctor (TypesL Host) [])); [ idtac | apply (if_id _) ].
  unfold FlatteningOfReification.
  unfold mf_F; simpl.
  apply if_inv.
  eapply if_comp.
  apply (if_associativity (garrow_functor (TypesEnrichedInJudgments Guest) HostMonic HostMonoidal GuestHost) F
    (retraction_retraction F)).
  eapply if_comp; [ idtac | apply if_right_identity ].
  apply (if_respects
    (garrow_functor (TypesEnrichedInJudgments Guest) HostMonic HostMonoidal GuestHost)

```

```
(garrow_functor (TypesEnrichedInJudgments Guest) HostMonic HostMonoidal GuestHost)
(F >>>> retraction_retraction F)
(functor_id _)).
apply (if_id _).
apply retraction_composes.
Qed.
```

End Flattening.