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To whom it may concern

I am writing in support of the research programme "Logical Relations for Program Verification" proposed by Dr Patricia Johann and Prof Neil Ghani of the University of Strathclyde.

I am a Researcher at Microsoft Research Cambridge where I have worked for over ten years. My research spans practical and theoretical aspects of programming languages. I was the co-inventor and implementor of the *generics* feature of the .NET runtime and language family, including the widely-used C# and Visual Basic programming languages, and more recently designed and implemented the *units-of-measure* feature of Microsoft's F# programming language. In connection with this latter project I developed a semantic theory of units-of-measure in programming, based on Logical Relations; with Nick Benton and other researchers I have also used Logical Relations to characterize the semantics of effect types and reason about contextual equivalence in effect systems.

Most recently I have collaborated directly with Dr Johann, Prof Ghani and Dr Atkey at the University of Strathclyde, developing a general theory of the semantics of polymorphism in the presence of algebraic theories of type indices, of which units-of-measure is just one instance. The collaboration has proved very fruitful, with a paper submitted to a top-tier conference (POPL) and hopefully more to follow.

Nevertheless, this work, along with much other recent work on logical relations, is in a sense "ad-hoc" in that the particular mathematical constructions involved must be built from scratch for each new situation. Ghani and Johann have an excellent track record in using *category theory* to bring some order to this area, both *explaining* why seemingly ad-hoc definitions work, but also *deriving* new structures by starting from well-known categorical constructions. One of the trickiest aspects of the units-of-measure work and its recent generalization was in identifying precisely the circumstances under which the central Abstraction Theorem holds. Category Theory ideally suits this identification problem, and so I am particularly excited by WP5 in which Johann and Ghani propose to use categories as a framework for algebraically indexed types. I am likewise interested in WP6 which offers the hope of sorting out the somewhat messy generalizations of reference [5] that my colleagues and I have developed – and are still attempting to develop.

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With regard to WP5 I am keen to collaborate directly with Dr Johann and Prof Ghani. This would involve at least two week-long visits to MSR Cambridge, which I would be very happy to host, with additional follow-up meetings should the collaboration prove particularly fruitful.

I have no hesitation in recommending that this research programme be funded.

Yours sincerely

Dr Andrew Kennedy