

Title: A formalization of one of the main claims of “Dunbar's number’ deconstructed” by Lindenfors et al. 2021

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http://purl.org/np/RAbWbJCYILhIYBDn9PVxdJP_WUbbi058aRcK-3sOJsRwY

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Abstract:

Lindenfors et al. claimed in previous work that the cortex size of humans does not relate to their social group size. We present here a formalization of that claim, stating that all things of class “relative neocortex size” that are in the context of a thing of class “social group” never have a relation of type “affects” to a thing of class “social group size” in the same context.

1. Introduction

Lindenfors et al. [1] state that “A cognitive limit on human group size cannot be derived in this manner.”. We present here a formalization of the main scientific claim from this quote by using a semantic template called the super-pattern [2].

2. Formalization

Our formalization looks as follows:

CONTEXT-CLASS (“in the context of all ...”): [social group](#)

SUBJECT-CLASS (“things of type ...”): [relative neocortex size](#)

QUALIFIER: [never](#)

RELATION-TYPE (“have a relation of [affects](#) type...”):

OBJECT-CLASS (“to things of type...”): [social group size](#)

In the context class, we use “social group” (Q874405) from Wikidata. In the subject class, we use a new minted class “relative neocortex size” that is related to the class “size”(Q1152227) and “neocortex” (Q726562) from Wikidata. In the object class, we minted a new class “social group size” that is a subclass of “social group” (Q874405) from Wikidata.

3. RDF Code

This is our formalization as a nanopublication in TriG format:

```
@prefix this: <http://purl.org/np/RAbWbJCYlLhlyBDn9FVxdJP_WUbbi058aRcK-3sOJsRwY> .
@prefix sub: <http://purl.org/np/RAbWbJCYlLhlyBDn9FVxdJP_WUbbi058aRcK-3sOJsRwY#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/o/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix sp: <https://w3id.org/linkflows/superpattern/terms/> .

sub:Head {
  this: np:hasAssertion sub:assertion ;
  np:hasProvenance sub:provenance ;
  np:hasPublicationInfo sub:pubinfo ;
  a np:Nanopublication .
}
sub:assertion {
  sub:spl a sp:SuperPatternInstance ;
  rdfs:label "The cortex size of humans does not relate to their social group size" ;
  sp:hasContextClass <http://www.wikidata.org/entity/Q874405> ;
  sp:hasSubjectClass <http://purl.org/np/RAhnnMWM8M29NixCJfVDLwzRzwCPnUD7LI2kxT-FME#relative-neocortex-size> ;
  sp:hasQualifier sp:neverQualifier ;
  sp:hasRelation sp:affects ;
  sp:hasObjectClass <http://purl.org/np/RAlKYv_sE8qwiSqsRdcr7KrkUlbsqlqiFmhDptPBwpLrM#social-group-size> .
}
sub:provenance {
  sub:activity a sp:FormalizationActivity ;
  prov:used sub:quote , <https://royalsocietypublishing.org/doi/10.1098/rsbl.2021.0158> ;
  prov:wasAssociatedWith orcid:0000-0002-0191-7211 .
  sub:assertion prov:wasGeneratedBy sub:activity .
  sub:quote prov:value "A cognitive limit on human group size cannot be derived in this manner." ;
  prov:wasQuotedFrom <https://royalsocietypublishing.org/doi/10.1098/rsbl.2021.0158> .
}
sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
  npx:hasPublicKey
    "MIGfMA0GCsGIB3DQEBAQUAA4GNADCBiQKBgQC3cICbOHZlecULosgovKwU1FRRvNWNgbJxoXCfAYWtU2OK97i/SjoIaxFphg9tkv9WxOjtpQYJ4cuM0E76wxeRZ7VB
    MHBBrIyCAGTvaFESWVQZCDgulg46VjffEzXuRmqOka/C5Ur6beLijFPMtiWEg6I2MbJ8z9vuHPxReIu4JwIDAQAB" ;
  npx:hasSignature
    "2FigeQHif/2I2T/QsVTqDThjV1P0Uy4IkGEmOC8W/Iygn8sGpJt4DOBDLDrT2egAwiesYqFvQsDQnWceY2C/yaViob6j49CYlZor+VZQo1HdsGvEq3V7xiLobl/w4sM
    PxA690y9DF5zp8w3wggXaJxMjrAESSCpaPxtnKGht0=" ;
  npx:hasSignatureTarget this: .
  this: dct:created "2021-11-17T18:03:20.686+01:00"^^xsd:dateTime ;
  dct:creator orcid:0000-0002-0191-7211 ;
  npx:introduces sub:spl ;
  npx:supersedes <http://purl.org/np/RA7MgxMCCvYkE2RBJHm-Ou_CuuhPXqfcinswtIfjXReOc> ;
  <https://w3id.org/linkflows/reviews/isUpdateOf> <http://purl.org/np/RAYJelruxzvy8idGuxziYN4ri80FeKZxzK-QdJPvDug0> ;
```

```

    nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RAB_oyl0D3XUP-zYlqGz7Uj58AsUXhEKeGgmRFg5LSgDM> ;
    nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RA2vCBXZf-icEcVRGhulJXugTGxpsV5yVr9yqCI1bQh4A> ,
    <http://purl.org/np/RAA2MfqdBczmz9yVWjKLXNbyfBNcwsMmOqcNuxkk1maIM> ,
    <http://purl.org/np/RAjpBM1w3owYhJUBo3DtsuD1XsNAJ8cnGeWAutDVjuAuI> ;
    nt:wasCreatedFromTemplate <http://purl.org/np/RAv68imZrEjfcP2rnEglhzoBqEvc0cQMtp9_1Za0BxNM4> .
}

```

The following nanopublications introduce the newly minted classes in TriG format.

This is the class definition of “relative neocortex size”:

```

@prefix this: <http://purl.org/np/RAhnnsmMwVM8M29NixCJfVDLWzRzwwCPnUD7LI2kxT-FME> .
@prefix sub: <http://purl.org/np/RAhnnsmMwVM8M29NixCJfVDLWzRzwwCPnUD7LI2kxT-FME#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/o/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

sub:Head {
  this: np:hasAssertion sub:assertion ;
  np:hasProvenance sub:provenance ;
  np:hasPublicationInfo sub:pubinfo ;
  a np:Nanopublication .
}
sub:assertion {
  sub:relative-neocortex-size a <http://www.w3.org/2002/07/owl#Class> ;
  rdfs:label "Relative size of the neocortex" ;
  skos:definition "This class signifies the weight or volume of a part of the brain called neocortex." ;
  skos:relatedMatch <http://www.wikidata.org/entity/Q322481> , <http://www.wikidata.org/entity/Q726562> .
}
sub:provenance {
  sub:assertion prov:wasAttributedTo orcid:0000-0002-0191-7211 .
}
sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
  npx:hasPublicKey
    "MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQC3cICbOHZlecULosgovKwU1FRRvNWNGBJxoXCFAYWtU2OK97i/SjoIaxFphg9tkv9WxOjtpQYJ4cuM0E76wxeRZ7VB
    MHBrBiyCAGTvaFEsWVQZCDgulg46VjffEzXuRmqOka/C5Ur6beLijFPMtiWEg6I2MbJ8z9vuHPxReIu4JwIDAQAB" ;
  npx:hasSignature
    "NMWYJ3I459BEhN7NgKELsfNucMayG4MXMMjOrZm0h+g/5Mbu8vbLVhkSi5C9N+SGc67qW6YtdndVxmrM7qpWfzUTv+FzVOgydGqs30VKUC5F0TNBzvTnTnvt9Bq61oQ5
    cNixUHeF6/Mqte2auchZPLgY8yap3ImLEaNTWwdQpTM=" ;
  npx:hasSignatureTarget this: .
  this: dct:created "2021-10-19T14:07:44.194+02:00"^^xsd:dateTime ;
  dct:creator orcid:0000-0002-0191-7211 ;
  npx:introduces sub:relative-neocortex-size ;
  npx:supersedes <http://purl.org/np/RAiWMZ0StXU9DCY1WGoJMwD2Nac30mijCb0FML8TXIB0Y> ;
  <https://w3id.org/linkflows/reviews/isUpdateOf> <http://purl.org/np/RAiWMZ0StXU9DCY1WGoJMwD2Nac30mijCb0FML8TXIB0Y> ;
  nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RAiWMZ0StXU9DCY1WGoJMwD2Nac30mijCb0FML8TXIB0Y> ;
  nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RAA2MfqdBczmz9yVWjKLXNbyfBNcwsMmOqcNuxkk1maIM> ,
  <http://purl.org/np/RAOGu9Lh0BD4tbIRB9RG6RGRA_ObDh75NTbIqaWgxxs8M> ,
  <http://purl.org/np/RAjpBM1w3owYhJUBo3DtsuD1XsNAJ8cnGeWAutDVjuAuI> ;
  nt:wasCreatedFromTemplate <http://purl.org/np/RAdpgrPigXtt8iPV9uOPf3wIT3qzOI8Sg2Q72CNV8g-Yo> .
}

```

This is the class definition of “social group size”:

```

@prefix this: <http://purl.org/np/RAlKYv_sE8qwiSqsRdcr7KrkU1bsqlqiFmhDPtPBwpLrM> .
@prefix sub: <http://purl.org/np/RAlKYv_sE8qwiSqsRdcr7KrkU1bsqlqiFmhDPtPBwpLrM#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/o/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

sub:Head {
  this: np:hasAssertion sub:assertion ;

```

```

    np:hasProvenance sub:provenance ;
    np:hasPublicationInfo sub:pubinfo ;
    a np:Nanopublication .
}
sub:assertion {
  sub:social-group-size a <http://www.w3.org/2002/07/owl#Class> ;
  rdfs:label "Social group size" ;
  rdfs:subClassOf <https://www.wikidata.org/wiki/Q874405> ;
  skos:definition "Social group size is the size of a group of humans that a person socially interacts with (on a regular basis)." .
}
sub:provenance {
  sub:assertion prov:wasAttributedTo orcid:0000-0002-0191-7211 .
}
sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
  npx:hasPublicKey
"MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQC3cICbOHZ1ecuLOsgovKwU1FRRvNWNgbJxoXCfAYWtU2OK97i/SjoiXfPhg9tkv9WxOjtpqYJ4cuM0E76wxeRZ7VB
MHBBrBIyCAGTVAfESWVQZCDgulg46VjffEzXuRmqOka/C5Ur6beLijFPMtiWEg6I2MbJ8z9vuHPxReIu4JwIDAQAB" ;
  npx:hasSignature
"WBZl0x+hSX0zXoXQAGBkM89SWDOnViMI8NoLH8w1GsJOWSjT/pasNugo6CEDZkwb5ZyHsXSzG7JDCldnhVQkH64Nuok6C3QvV9+EUVmZaDHBByMhObzJ3Pld8pYNHWTW
lwNve4xkb9lMzq5zYfBw+Y4ufB5Kqi39zHldr6XRZRo=" ;
  npx:hasSignatureTarget this: .
  this: dct:created "2021-06-22T09:49:42.152Z"^^xsd:dateTime ;
  dct:creator orcid:0000-0002-0191-7211 ;
  npx:introduces sub:social-group-size ;
  nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RANwQa4ICWS5SOjw7gp99nBpXBasapwtZF1fIM3H2gYTM> ;
  nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RAA2MfqdBczmz9yVWjKLXNbyfBNcwsMmOqcNUxkkImaIM> ;
  nt:wasCreatedFromTemplate <http://purl.org/np/RAdpgRpigXtt8iPV9uOPf3wIT3qzOI8Sg2Q72CNV8g-Yo> .
}

```

References

- [1] Lindenfors, P., Wartel, A. and Lind, J. ‘Dunbar's number’ deconstructed. Biol. Lett.(2021). doi: 10.1098/rsbl.2021.0158.
- [2] Bucur, C.I., Kuhn, T., Ceolin, D., Ossenbruggen, J. van. Expressing high-level scientific claims with formal semantics. In: Proceedings of the 11th Knowledge Capture Conference 2021. doi: 10.1145/3460210.3493561.