25th International Workshop on Computational Models of Natural Argument, Online, 12th December 2025

A Notation for Declaratively Describing Arguments

Simon Wells[1] & Mark Snaith[2]

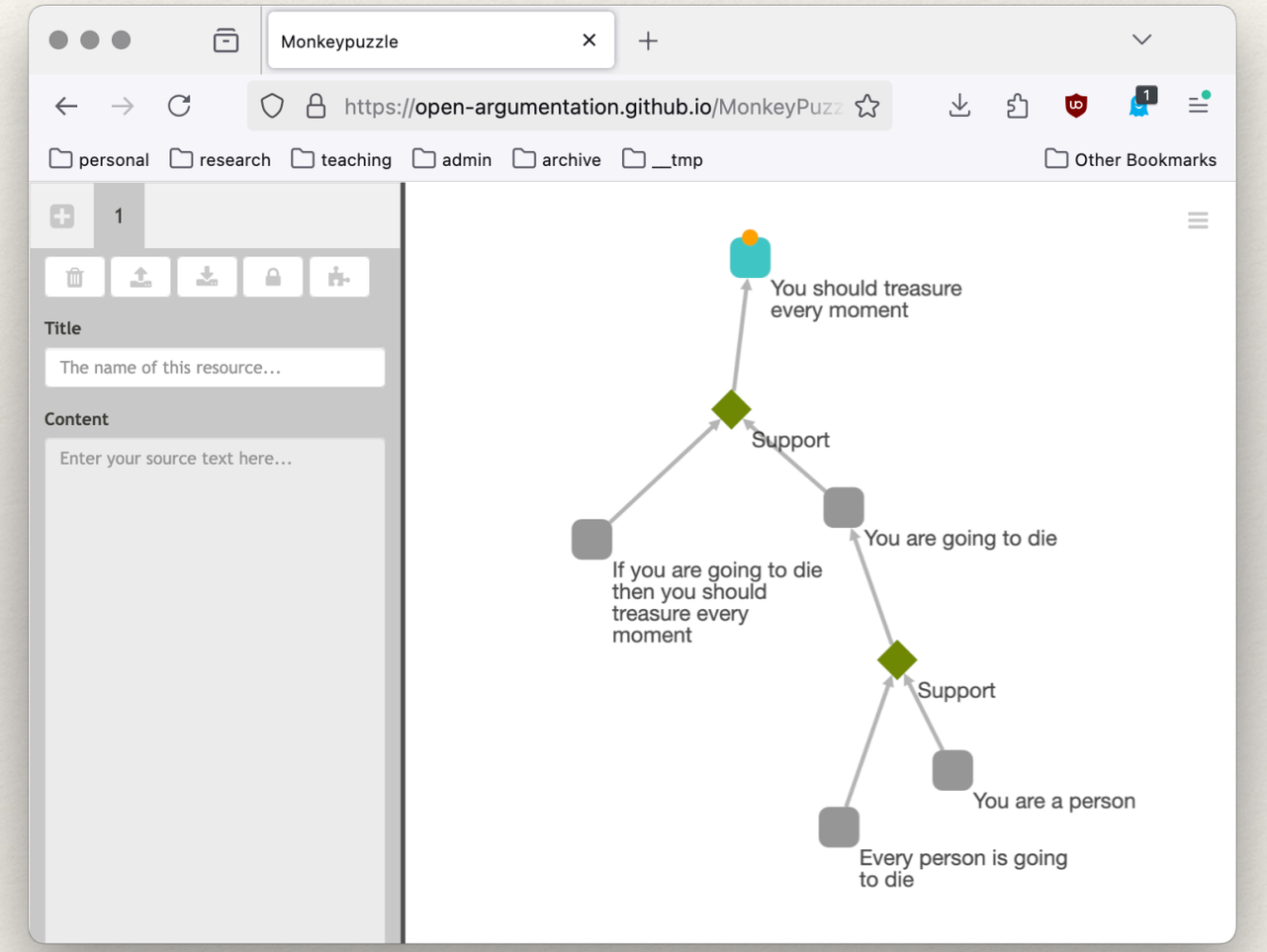
[1] *Edinburgh Napier University*
[2] *Robert Gordon University*

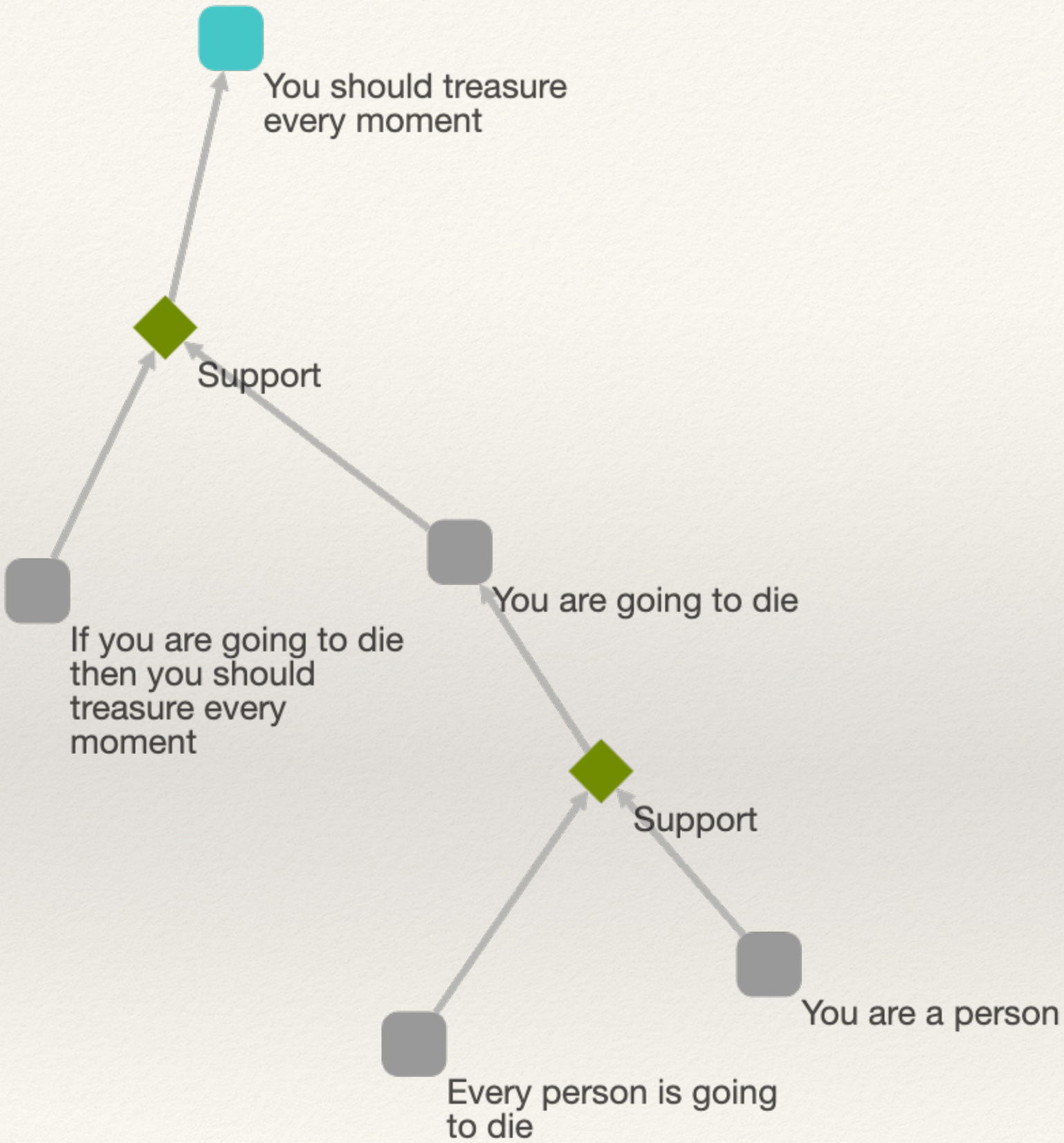
Alternatively: A Tale of Two Technologies

- We've been working on a range of software tools to for working with arguments:
  - PreFACE
  - SADFace

MonkeyPuzzle & SADFace

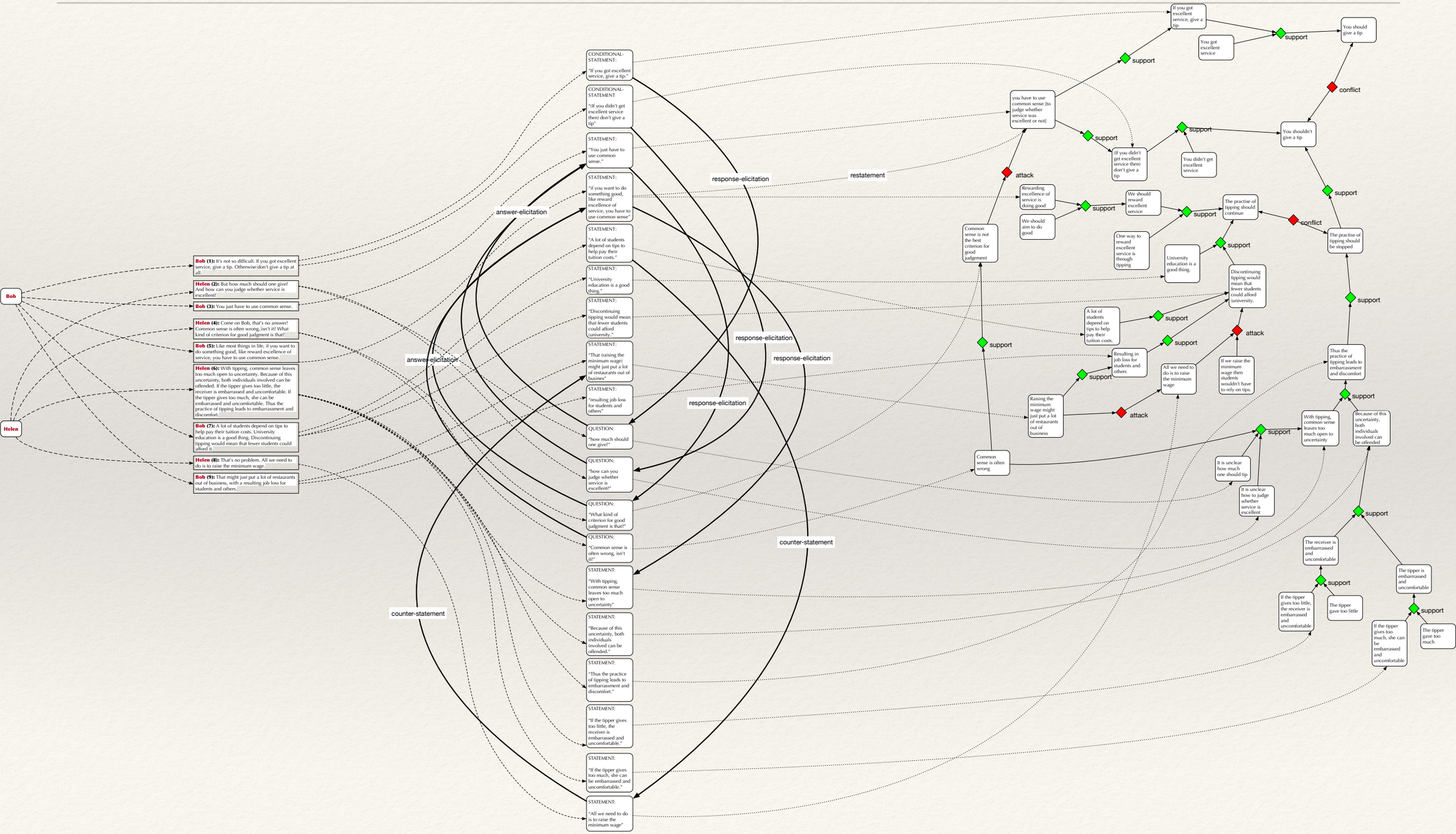
- MonkeyPuzzle was developed as a testbed for investigating ways to visually analyse arguments from multiple, multimedia, resources.
- Led to SADFace, the Simple Argument Description Format & ultimately to (OAPL) the Open Argumentation PLatform.






```
{
 "edges": [
  {
   "id": "a1s1",
   "source_id": "a1",
   "target_id": "s1"
  },
  {
   "id": "a2s1",
   "source_id": "a2",
   "target_id": "s1"
  },

                ...

 ],
 "metadata": {
  "core": {
   "analyst_email": "s.wells@napier.ac.uk",
   "analyst_name": "Simon Wells",
   "created": "2018-02-23T02:27:36",
   "edited": "2025-09-23T11:12:39",
   "id": "94a975db-25ae-4d25-93cc-1c07c932e2f9"
  }
 },
 "nodes": [
  {
   "id": "a1",
   "metadata": {},
   "sources": [],
   "text": "Every person is going to die",
   "type": "atom"
  },
  {
   "id": "a2",
   "metadata": {},
   "sources": [],
   "text": "You are a person",
   "type": "atom"
  },
  {
   "id": "s1",
   "name": "Support",
   "type": "scheme"
  },

                ...

 ],
 "resources": [
  {
   "id": "c4f04a87-79f6-479d-890d-496a89c9416f",
   "content": " ",
   "type": "text",
   "metadata": {}
  }
 ]
}
```

Zonal ARgumentative DialOgue visualiZation (ZARDOZ)



Edinburgh Napier UNIVERSITY

PreFACE

- A tool for regulating dialogues (agent-agent, agent-human, human-human).
- A framework for bringing together Dialogue Games (rich formal structure) & LLMs (good, human-level, generated utterances).
- Aim to overcome a range of issues from each technology:
  - structured dialogue with natural expression.
  - adaptive goal-oriented & goal-preserving behaviour.
  - Evidence-based output with explainability.
  - Formal structure, naturally phrased.
  - Grounded, domain-specific, multi-source knowledge.
- Essentially: an interface/wrapper around an LLM: provide scaffolding & context, generate prompt, evaluate result.

Conversation (paraphrased [quite heavily])

- **Mark:** "I've been doing this thing for PreFACE and I've invented this other thing."
- **Simon:** "Cool. That sounds like this thing I also built for SADFace to help with another thing."
- **Mark:** "These things are really quite similar."
- **Simon:** "Yes. If we've independently invented these two quite similar things then maybe others will find it useful?"
- **Both:** "Yes. Let's share our toys with the other children."

Edinburgh Napier UNIVERSITY

SADN

- The Simple Argument Description Notation.
- A simple, declarative language for describing arguments.
- Builds on SADFace
- Where SADFace is document-oriented, SADN is incremental and declarative

Edinburgh Napier UNIVERSITY

SADN Commands

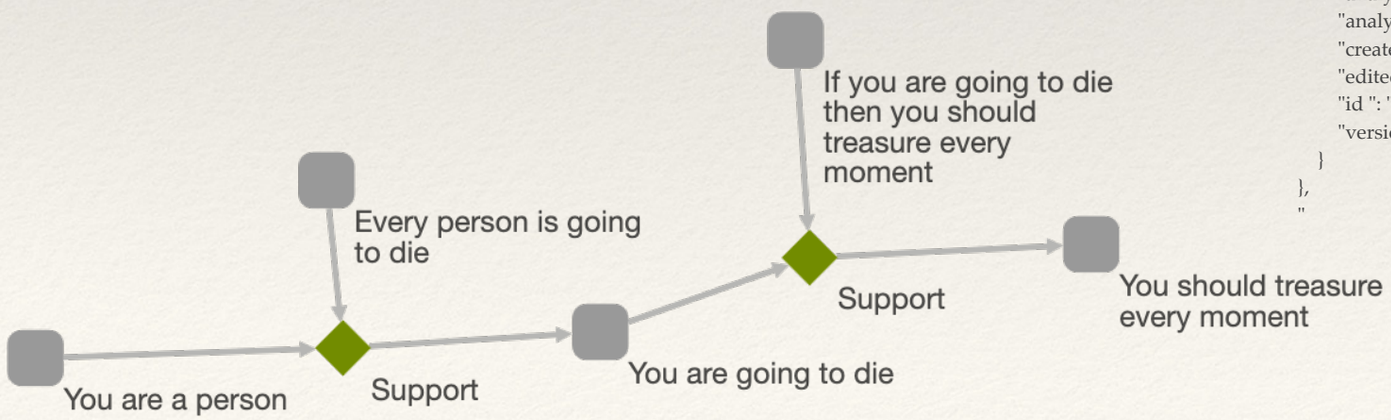
- Two basic structures: simple (bare command) & complex (taking argument) of which argument are either simple (individual datums) or complex (key:value pairs):
  - atom(id:$ID, text:$TEXT)
  - scheme(id:$ID, name:$TEXT)
  - support(scheme:$ID, conclusion:$ID, premise:$ID, ...)
  - attack(source:$ID, target:$ID)
  - disagree($ID, $ID, ...)
  - argument(scheme:$TEXT, conclusion:$ID | text:$CONTENT, premise:$ID | text:$CONTENT, …)
  - remove(id:$ID, ...)
  - metadata(id:$ID, namespace:$TEXT, $KEY:$TEXT
  - atoms, schemes, conflicts , edges
  - export(type:$TYPE)
  - save(type:$TYPE, name:$PATHNAME)
  - load(name:$PATHNAME)
  - clear, print, prettyprint, help

Aliasing

- SADFace is constructed around globally unique identifiers (UUIDs) for the overall analysis, as well as for individual nodes, edges, & resources within it.
  - e.g. "id": "b00535db–25b8–45b4–99e9–2955fa0ba54c
- These are unwieldy for human UI usage.
- So we use aliasing to map SADFace UUIDs to local identifiers for the following types: atoms (a), schemes (s), edges (e), supports (u), and conflicts (c).
- Local IDs use the identifier letter code for the type as well as monotonically increasing interger IDs for each UUID, so a list of atoms might be [a1, a2, a3, …]
- Internally SADN maintains lookup tables to enable the SADFace UUID to be retrieved for any local ID, and vice versa.
- Local IDs are not maintained between SADN sessions and are generated as necessary at runtime then discarded once the session ends. Only SADFace UUIDs persist.

Worked Example

- Recreate the MonkeyPuzzle example argument using SADN to interactively declare the elements of the argument and build the resulting model in an incremental fashion.




```
{
  "edges": [
    {
      "id": "81d94ca5-4cb1-4c4d-8486-708d45b45c4e",
      "source_id": "a03ea3f2-70f2-42ed -962c-f15367e79de7",
      "target_id": "b3b0e13a-8b8b-4e2a-9544-5ab401e58999"
    },
    {
      "id": "233 af9c1-ba7e-4967-9c32-3025ac65ee67",
      "source_id": "b3b0e13a-8b8b-4e2a-9544-5ab401e58999 ",
      "target_id": "bba487d5-029a-4a1b-ae79-ad69c769382a"
    },
    {
      "id": "75c9ef27-7ba4-4cbf-8fde -e957698f472b",
      "source_id": "6e73e177-4e62-45e4-bd0d-62d72891c339",
      "target_id": " b3b0e13a-8b8b-4e2a-9544-5ab401e58999"
    },
    {
      "id": "e21ddbcc-ce50-4ce9-839e-5f8f5e2d5af4",
      "source_id": "df8e97d1-b2d6-4768-bd82-ea91a8820313",
      "target_id": "42ba2acc-d8d2-4d8f -ae93-c7f8c383b4bb"
    },
    {
      "id": "adbc1971-5334-4daa-86bb-d7d706a3b8cc",
      "source_id": "42 ba2acc-d8d2-4d8f-ae93-c7f8c383b4bb",
      "target_id": "3b666117-d50c-4de8-b2ed-29 f6ae98f10a"
    },
    {
      "id": "00695abb-e8aa-4f08-9af8-7fca55d53270",
      "source_id": "bba487d5-029a -4a1b-ae79-ad69c769382a",
      "target_id": "42ba2acc-d8d2-4d8f-ae93-c7f8c383b4bb"
    }
  ],
  " metadata": {
    "core": {
      "analyst_email": "Default Analyst Email",
      "analyst_name": "Default Analsyst Name",
      "created": "2025-10-29T17:53:05",
      "edited": "2025-10-29T18:50:13",
      "id ": "4ab333ea-a003-4631-afa7-5f20806a8497",
      "version": "0.5.3.2"
    }
  },
  "
```

```
"nodes": [
    {
      "id": " a03ea3f2-70f2-42ed-962c-f15367e79de7",
      "type": "atom",
      "text": "Every person is going to die",
      "sources": [],
      "metadata": {}
    },
    {
      "id": "6e73e177-4e62-45e4-bd0d-62d72891c339",
      "type ": "atom",
      "text": "You are a person",
      "sources": [],
      "metadata": {}
    },
    {
      "id": "bba487d5-029a -4a1b-ae79-ad69c769382a",
      "type": "atom",
      "text": "You are going to die",
      "sources": [],
      "metadata": {}
    },
    {
      "id": "b3b0e13a-8b8b-4e2a-9544-5ab401e58999",
      "type": "scheme",
      "name": " Support"
    },
    {
      "id": "df8e97d1-b2d6-4768-bd82-ea91a8820313",
      "type": "atom",
      "text": "If you are going to die then you should treasure every momer
      "sources": [],
      "metadata ": {}
    },
    {
      "id": "3b666117-d50c-4de8-b2ed-29f6ae98f10a",
      "type": "atom",
      "text": "You should treasure every moment",
      "sources": [],
      "metadata": {}
    },
    {
      "id": "42ba2acc-d8d2-4d8f-ae93- c7f8c383b4bb",
      "type": "scheme",
      "name": "Support"
    }
  ],
  "resources": []
}
```

- Start the SADFace REPL
- This gives access to an interactive environment where we can type SADN commands at the “>” prompt

```
The SADFace REPL. Type 'help' or 'help <command>' for assistance
>
```

- We can use the prettyprint command (or ‘pp’ shorthand) to see the state of the SADFace model.
- Default values are generated and inserted if a configuration file is not supplied.

```
The SADFace REPL. Type ’help’ or ’help <command>’ for assistance
> pp
{
    "edges": [],
    "metadata": {
        "core": {
        "analyst_email": "Default Analyst Email",
        "analyst_name": "Default Analsyst Name",
        "created": "2025-10-29T17:53:05",
        "edited": "2025-10-29T17:53:30",
        "id": "4ab333ea-a003-4631-afa7-5f20806a8497",
        "version": "0.5.3.2"
    }
    },
    "nodes": [],
    "resources": []
}
>
```

- We use the atom() command to introduce three new atoms to the model.
- We then use the print command to show the SADFace model
- Finally we use the atoms command to list the atoms introduced so far.

```
> atom(text:"Every person is going to die")
> atom(text:"You are a person")
> atom(text:"You are going to die")
> print
{"edges":[],"metadata":{"core":{"analyst_email":"Default Analyst Email","analyst_name":"
    Default Analsyst Name","created":"2025-10-29T17:53:05","edited":"2025-10-29T17
    :53:30","id":"4ab333ea-a003-4631-afa7-5f20806a8497","version":"0.5.3.2"}},"nodes
    ":[{"id":"a03ea3f2-70f2-42ed-962c-f15367e79de7","type":"atom","text":"Every person
    is going to die","sources":[],"metadata":{}},{"id":"6e73e177-4e62-45e4-bd0d-62
    d72891c339","type":"atom","text":"You are a person","sources":[],"metadata":{}},{"id
    ":"bba487d5-029a-4a1b-ae79-ad69c769382a","type":"atom","text":"You are going to die
    ","sources":[],"metadata":{}}],"resources":[]}
>atoms
["a1":{"id":"a03ea3f2-70f2-42ed-962c-f15367e79de7", "text":"Every person is going to die
    "}, "a2":{"id":"6e73e177-4e62-45e4-bd0d-62d72891c339", "text":"You are a person"}, "
    a3":{"id":"bba487d5-029a-4a1b-ae79-ad69c769382a", "text":"You are going to die"}]
```

- We add a support relationship between the three atoms introduced thus far.
- This introduces an undifferentiated default “support” scheme between them.
- We use the schemes command to list the schemes introduced so far to the SADFace model.
- We then print the SADFace model to see the status of our model.

```
> support(conclusion:"a3", premise:"a1", premise:"a2")
>schemes
["s1":{"id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999", "name":"Support"}]
> print
{"edges":[{"id":"81d94ca5-4cb1-4c4d-8486-708d45b45c4e","source_id":"a03ea3f2-70f2-42ed
    -962c-f15367e79de7","target_id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999"},{"id":"233
    af9c1-ba7e-4967-9c32-3025ac65ee67","source_id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999
    ","target_id":"bba487d5-029a-4a1b-ae79-ad69c769382a"},{"id":"75c9ef27-7ba4-4cbf-8fde
    -e957698f472b","source_id":"6e73e177-4e62-45e4-bd0d-62d72891c339","target_id":"
    b3b0e13a-8b8b-4e2a-9544-5ab401e58999"}],"metadata":{"core":{"analyst_email":"Default
     Analyst Email","analyst_name":"Default Analsyst Name","created":"2025-10-29T17
    :53:05","edited":"2025-10-29T18:02:25","id":"4ab333ea-a003-4631-afa7-5f20806a8497","
    version":"0.5.3.2"}},"nodes":[{"id":"a03ea3f2-70f2-42ed-962c-f15367e79de7","type":"
    atom","text":"Every person is going to die","sources":[],"metadata":{}},{"id":"6
    e73e177-4e62-45e4-bd0d-62d72891c339","type":"atom","text":"You are a person","
    sources":[],"metadata":{}},{"id":"bba487d5-029a-4a1b-ae79-ad69c769382a","type":"atom
    ","text":"You are going to die","sources":[],"metadata":{}},{"id":"b3b0e13a-8b8b-4
    e2a-9544-5ab401e58999","type":"scheme","name":"Support"}],"resources":[]}
```

- Finally we use the argument() command to introduce an entire support structure in a single command.
- This is a mix of existing local IDs and new text content.
- Atoms are created in the background to account for new texts.
- We then list atoms and schemes as before then print the model.

```
> argument(conclusion: "You should treasure every moment", premise: "a3", premise: "If
    you are going to die then you should treasure every moment")
> atoms
["a1":{"id":"a03ea3f2-70f2-42ed-962c-f15367e79de7", "text":"Every person is going to die
    "}, "a2":{"id":"6e73e177-4e62-45e4-bd0d-62d72891c339", "text":"You are a person"}, "
    a3":{"id":"bba487d5-029a-4a1b-ae79-ad69c769382a", "text":"You are going to die"}, "
    a4":{"id":"3b666117-d50c-4de8-b2ed-29f6ae98f10a", "text":"You should treasure every
    moment"}, "a5":{"id":"df8e97d1-b2d6-4768-bd82-ea91a8820313", "text":"If you are
    going to die then you should treasure every moment"}]
> schemes
["s1":{"id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999", "name":"Support"}, "s2":{"id":"42
    ba2acc-d8d2-4d8f-ae93-c7f8c383b4bb", "name":"Support"}]
> print
{"edges":[{"id":"81d94ca5-4cb1-4c4d-8486-708d45b45c4e","source_id":"a03ea3f2-70f2-42ed
    -962c-f15367e79de7","target_id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999"},{"id":"233
    af9c1-ba7e-4967-9c32-3025ac65ee67","source_id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999
    ","target_id":"bba487d5-029a-4a1b-ae79-ad69c769382a"},{"id":"75c9ef27-7ba4-4cbf-8fde
    -e957698f472b","source_id":"6e73e177-4e62-45e4-bd0d-62d72891c339","target_id":"
    b3b0e13a-8b8b-4e2a-9544-5ab401e58999"},{"id":"e21ddbcc-ce50-4ce9-839e-5f8f5e2d5af4
    ","source_id":"df8e97d1-b2d6-4768-bd82-ea91a8820313","target_id":"42ba2acc-d8d2-4d8f
    -ae93-c7f8c383b4bb"},{"id":"adbc1971-5334-4daa-86bb-d7d706a3b8cc","source_id":"42
    ba2acc-d8d2-4d8f-ae93-c7f8c383b4bb","target_id":"3b666117-d50c-4de8-b2ed-29
    f6ae98f10a"},{"id":"00695abb-e8aa-4f08-9af8-7fca55d53270","source_id":"bba487d5-029a
    -4a1b-ae79-ad69c769382a","target_id":"42ba2acc-d8d2-4d8f-ae93-c7f8c383b4bb"}],"
    metadata":{"core":{"analyst_email":"Default Analyst Email","analyst_name":"Default
    Analsyst Name","created":"2025-10-29T17:53:05","edited":"2025-10-29T18:50:13","id
    ":"4ab333ea-a003-4631-afa7-5f20806a8497","version":"0.5.3.2"}},"nodes":[{"id":"
    a03ea3f2-70f2-42ed-962c-f15367e79de7","type":"atom","text":"Every person is going to
     die","sources":[],"metadata":{}},{"id":"6e73e177-4e62-45e4-bd0d-62d72891c339","type
    ":"atom","text":"You are a person","sources":[],"metadata":{}},{"id":"bba487d5-029a
    -4a1b-ae79-ad69c769382a","type":"atom","text":"You are going to die","sources":[],"
    metadata":{}},{"id":"b3b0e13a-8b8b-4e2a-9544-5ab401e58999","type":"scheme","name":"
    Support"},{"id":"df8e97d1-b2d6-4768-bd82-ea91a8820313","type":"atom","text":"If you
    are going to die then you should treasure every moment","sources":[],"metadata
    ":{}},{"id":"3b666117-d50c-4de8-b2ed-29f6ae98f10a","type":"atom","text":"You should
    treasure every moment","sources":[],"metadata":{}},{"id":"42ba2acc-d8d2-4d8f-ae93-
    c7f8c383b4bb","type":"scheme","name":"Support"}],"resources":[]}
```

Applications

- Rapid, interactive, construction of arguments.
- TextUI for working with arguments.
- Interlingua for describing structured argumentative content, i.e. for use in LLMs and other ML.
- Investigating the narrative & temporal aspects of argumentative reasoning.
- Piping argumentative/debate data between tools.

Edinburgh Napier UNIVERSITY

Future Work

- Implementation is nearly complete:
  - Mostly testing & fine-tuning the language.
  - SADFace is both mature & gaining traction (according to download stats) so intend SADN to be ready for active use upon release.
- Tree-based edit model (temporal development of arguments)
- Use of SADN within PreFACE.
- Describing dialogue (wider SADFace development goal).

Edinburgh Napier UNIVERSITY

Conclusions

- Introduced SADN:
- A notation for declaratively describing arguments for use in constructing, analysing, understanding, and mapping argumentative dialogue.

Edinburgh Napier UNIVERSITY

Acknowledgements

- The authors wish to thank our reviewers for the kind, interested, and useful suggestions which will inform the future directions of this work.
- Partly supported by the Engineering and Physical Sciences Research Council (EPSRC) of the UK Government (grant number UKRI220).

Edinburgh Napier UNIVERSITY

References

- M. Snaith & S. Wells (2021) "Towards a Declarative Approach to Constructing Dialogue Games" in proceedings of the 21st International Workshop on Computational Models of Natural Argument (CMNA'21)
- M. Snaith & S. Wells (2024) "Formal Dialogue and Large Language Models", presented at the SICSA Workshop on Reasoning, Explanations and Applications of Large Language Models (REALLM), Aberdeen, UK.
- M. Snaith & S. Wells (2025) "Retrieval Augmented Generation for Immersive Formal Dialogue" Post-proceedings of the 5th European Conference on Argumentation (ECA 2025), *forthcoming*
- S. Wells and Douglas J. Monkeypuzzle: Towards next generation, free & open-source, argument analysis tools. In Proceedings of the 17th International Workshop on Computational Models of Natural Argument (CMNA17), 2017.
- S. Wells (2020) "The Open Argumentation PLatform (OAPL)" in Proceedings of Computational Models of Argument (COMMA 2020), Frontiers in Artifical Intelligence, Volume 326: Computational Models of Argument, pages 475-476, Perugia, Italy.