

**Tele Action Objects  
for**

**Prototyping of**

**Distributed  
Multimedia**

**Applications**

# Outline

- **Overview of TAO formalism**
- **Symbol-Relation Grammar for Teleaction Objects**
- **Visual Tools for a Multimedia IC Development Environment (MICE)**

- **Conclusions and Future Research**

# References

H.J. Chang, T.Y. Hou, A. Hsu, S.K. Chang, "The Management and Application of Tele-Action Objects", *ACM Multimedia Systems J.*, Vol. 3, No. 5-6, 1995, pp. 204-216.

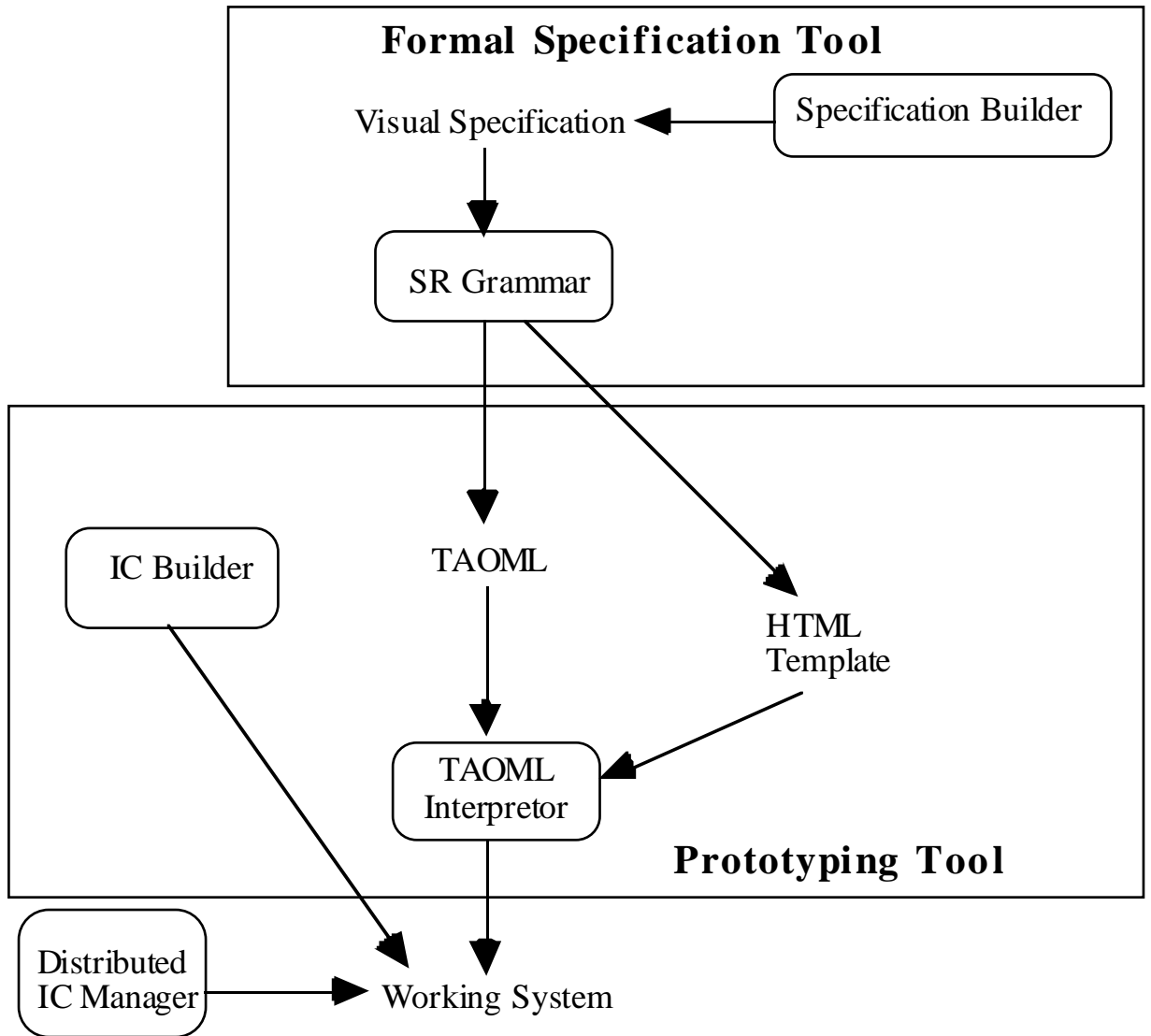
T. Arndt, A. Cafiero, A. Guercio, "Multimedia Languages for Teleaction Objects", *Proceedings of 1997 IEEE Symposium on Visual Languages*, pp. 318-327, September 1997.

T. Arndt, A. Cafiero, A. Guercio, "Symbol Relation Grammars for Teleaction Objects", Technical Report, Dipartimento di Informatica ed Applicazioni, University of Salerno, 1997.

T. Arndt, S.K. Chang, A. Guercio, "Visual Tools for a Multimedia IC Development Environment (MICE)", submitted to *1998 IEEE Symposium on Visual Languages*.

T. Arndt, S.K. Chang, A. Guercio, “Formal Specification and Prototyping of Multimedia Applications”, to be submitted.

# Multimedia Application Development using TAO



# TAOML

- An extended form of HTML
- Contains special TAO-related tags
- Translated into standard HTML to allow browser-based protootyping



# TAOML - BNF

TAO\_HTML ::= <TAO> TAO\_BODY </TAO>

TAO\_BODY ::= NAME\_PART TYPE\_PART P\_PART  
LINK\_PART IC\_PART SENSI\_PART DATA\_PART

NAME\_PART ::= <TAO\_NAME> "name" </TAO\_NAME>

TYPE\_PART ::= <TAO\_TYPE> TYPE\_SET </TAO\_TYPE>

TYPE\_SET ::= [image, text, audio, motion\_graph, video, mixed]

P\_PART ::= <TAO\_TEMPLATE> "template\_name"  
</TAO\_TEMPLATE>

LINK\_PART ::= empty | <TAO\_LINKS> LINK\_BODY  
</TAO\_LINKS> LINK\_PART

LINK\_BODY ::= name = "link\_name", type = LINK\_TYPE, obj =  
"link\_obj"

LINK\_TYPE ::= [spatial, temporal, structural]

IC\_PART ::= empty | <TAO\_IC> flag=FLAG ic\_type="a\_string"  
ic\_id\_list="a\_string" cgi\_pgm="a\_string" message\_type="a\_string"  
content="a\_string" </TAO\_IC>

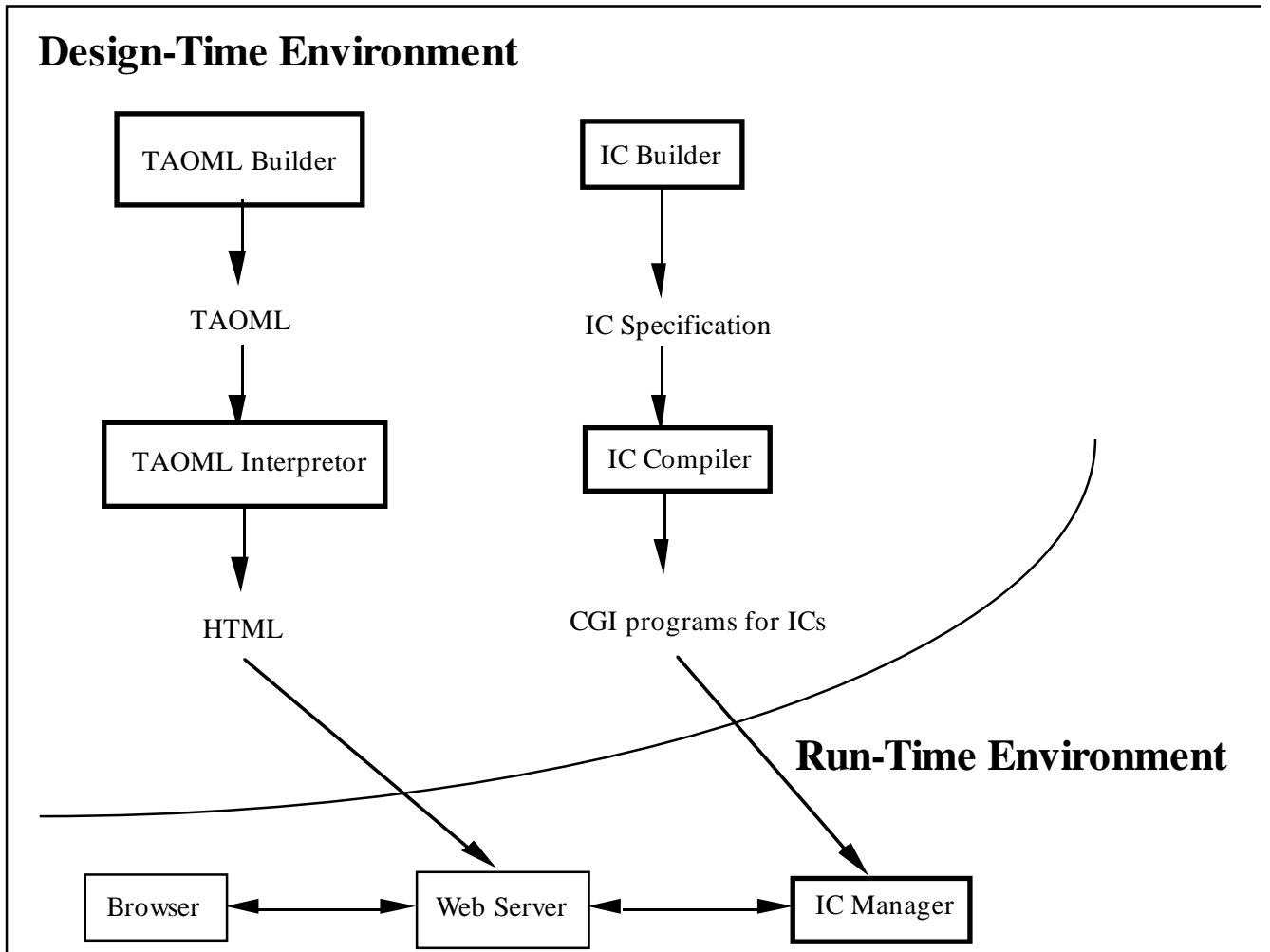
FLAG ::= [old, new]

SENSI\_PART ::= empty | <TAO\_SENSI> SENSITIVITY  
</TAO\_SENSI>

SENSITIVITY ::= [location, content, time]

DATA\_PART ::= empty | <TAO\_DATA> "database\_name"  
</TAO\_DATA>

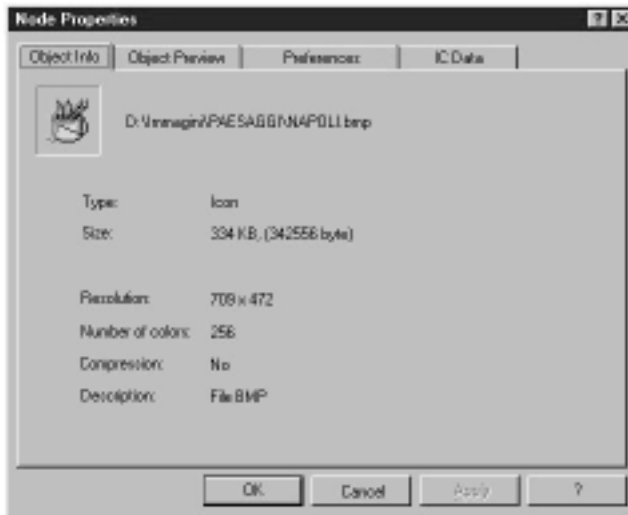
# MICE Tools



# TAOML Builder

- a visual tool for MICE application developers
- allows users to specify structure of a TAO as a hypergraph representing multimedia objects and relations between these objects
- automatically generates the TAOML corresponding to the visually specified TAO
- output is then used by the TAOML Interpreter
- TAOML Builder is based on the underlying multidimensional grammar previously described

# Node Properties



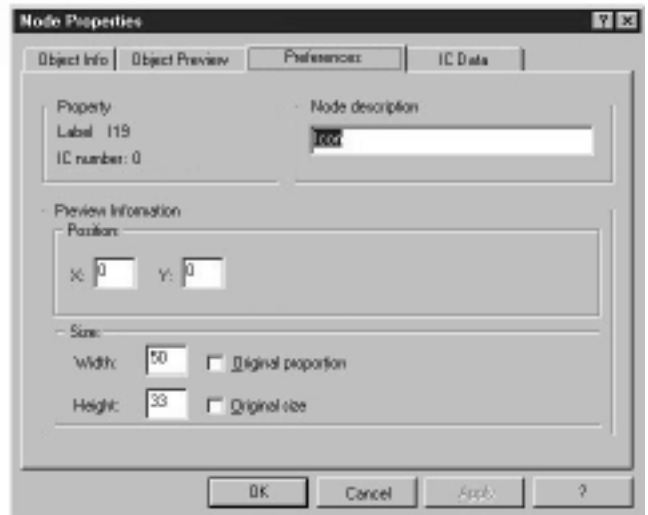
a



b

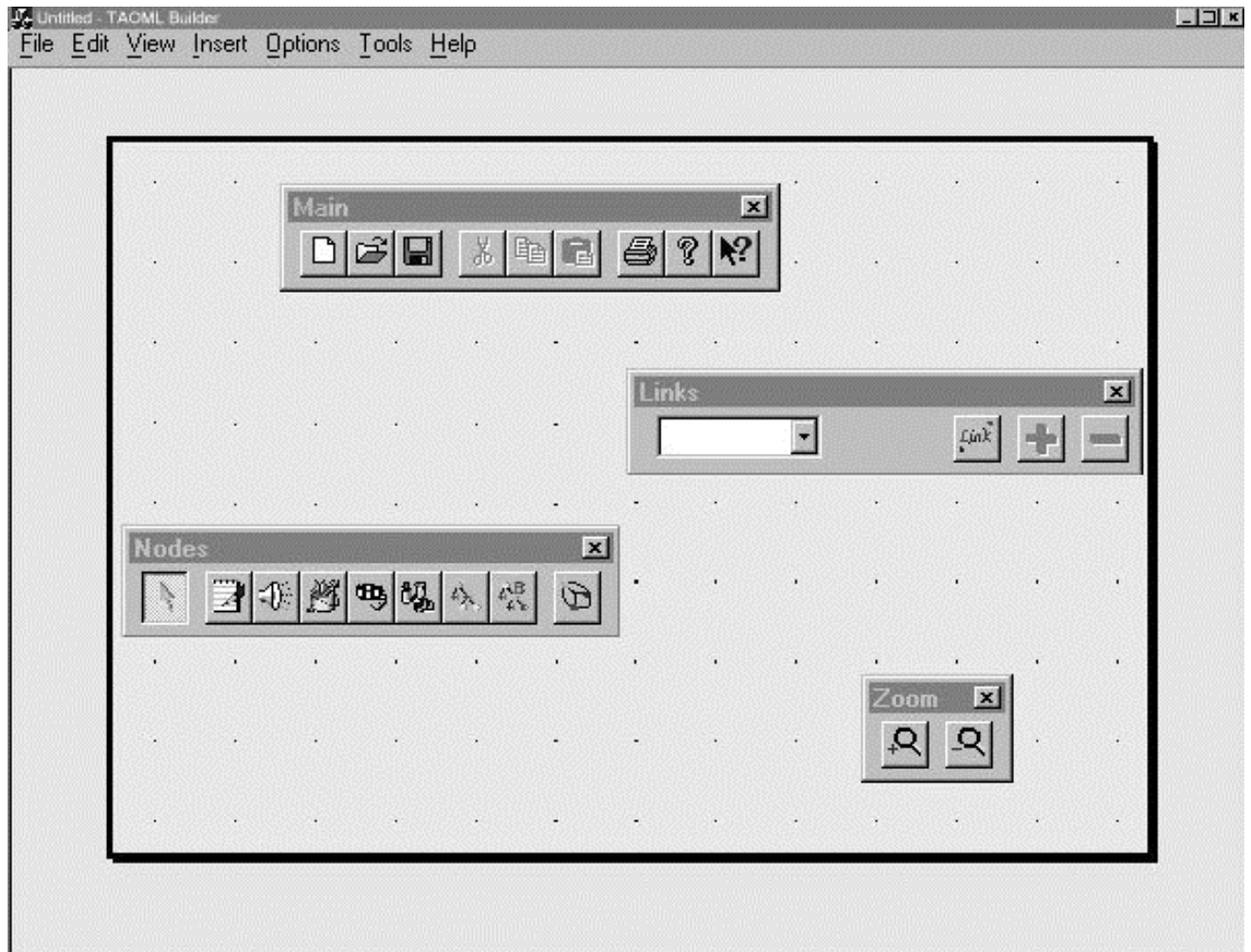


c



d

# TAOML Builder Toolbars



# Hypergraph and Matching TAOML

The screenshot displays the Bancoint - TAOML Builder application. The main workspace shows a hypergraph diagram with nodes and edges. The nodes are labeled: Welcome, Display, Body, Travel, Backgroui, Text, Text1, Text, and Text. The edges connect these nodes in a hierarchical structure. A context menu is open over the diagram, with the 'Create TAOML' option selected.

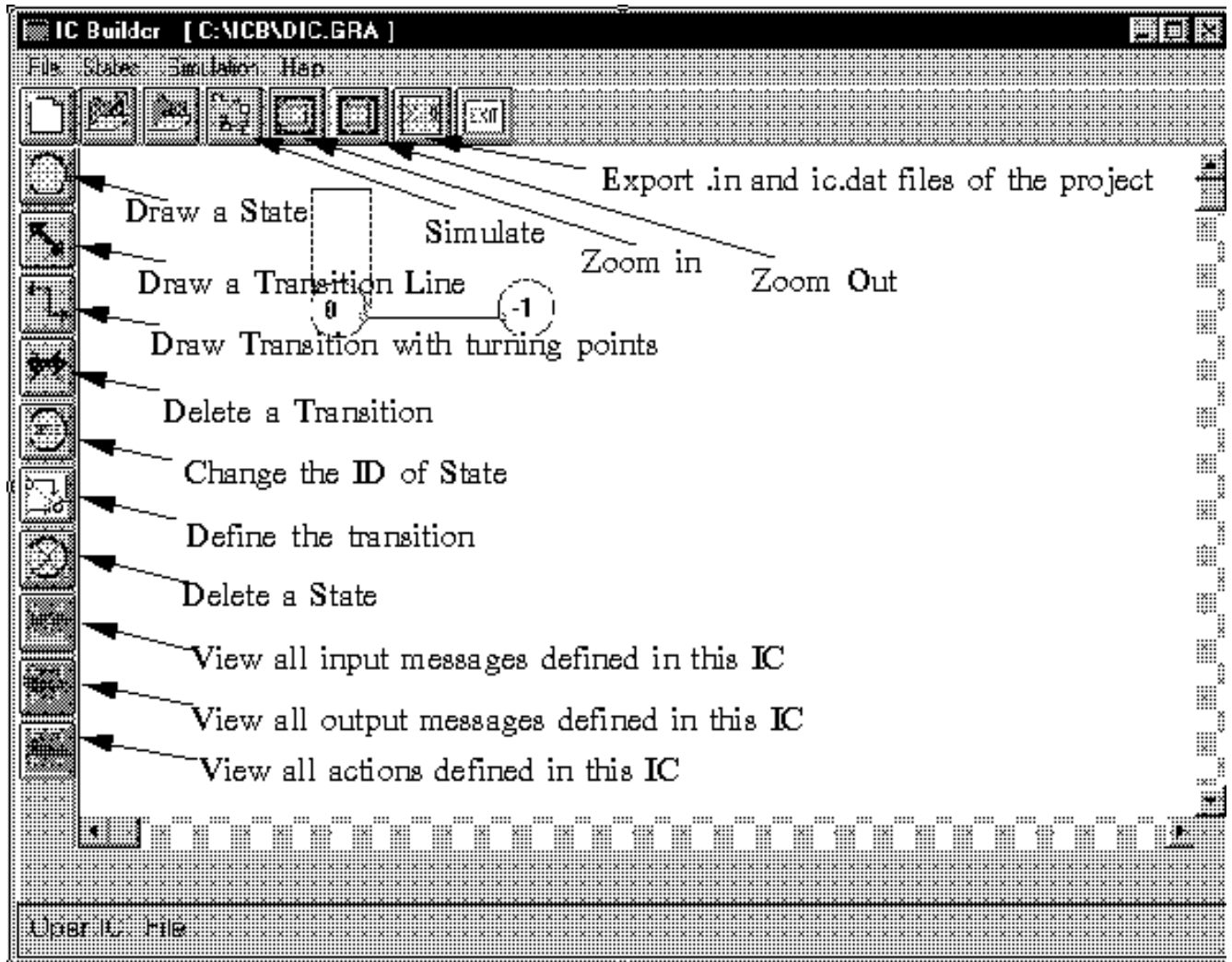
The TAOML Document window shows the following code:

```
====TAOML Document [ Welcome.taoml ]====  
<TAO>  
<TAO_NAME>"Welcome"</TAO_NAME>  
<TAO_TYPE>"Video"</TAO_TYPE>  
<TAO_TEMPLATE>"Welcome.tpl"</TAO_TEMPLATE>  
<TAO_LINKS>  
name = "Ref M1", type = structural , obj = "Display.taoml"  
</TAO_LINKS>  
<TAO_IC>  
flag = new  
ic_type = "Welcome"  
ic_id_list = "Display"  
message_type = "Touch screen"  
message_content = "Start system"  
cgi = ""  
</TAO_IC>  
</TAO>  
  
====Document Template [ Welcome.tpl ]====  
<!-- #name = Ref M1= reference -->  
<A HREF = "Display.taoml"> Ref M1</A>  
<!-- #Type=Vicon #File= #X=12 #Y=16 -->
```

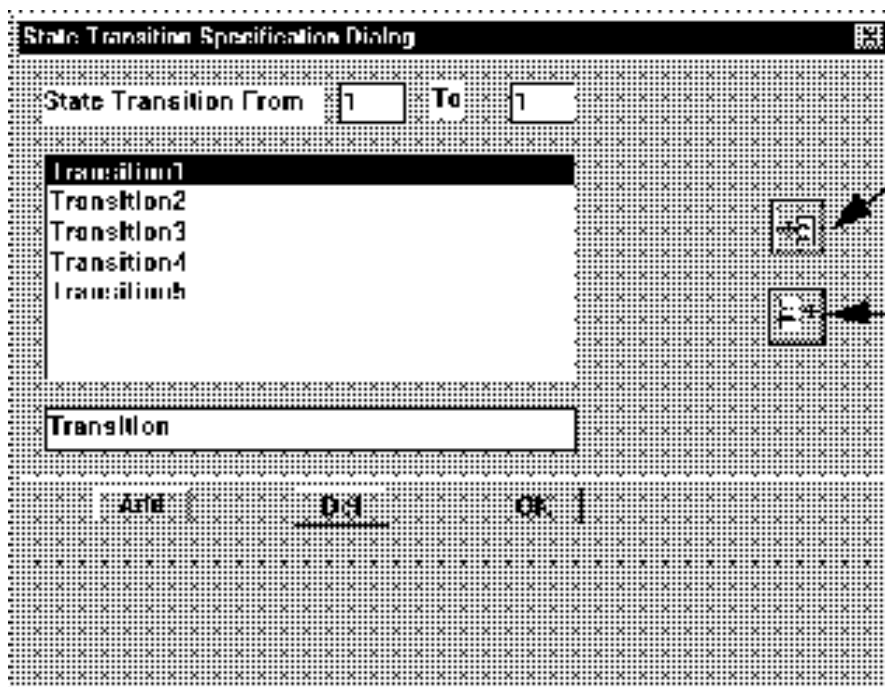




# IC Builder Main Screen



# Defining a Transition



Define Input  
Message( f function )

Define Output  
Message( g function )

# Other Mice Tools

- TAOML Interpreter
- IC Compiler
- IC Manager

# **Conclusions and Future Research**

- **Formal Methodology for  
Specification of TAOs**
- **Tools for Prototyping of  
TAO-Based Applications**
- **Syntax-Directed TAO  
Editor**
- **Grammar-Based  
Property Proving?**

- **Integration of MICE Tools**
- **TAOML as XML Application**