






# The Journey of an APL2 Bigot to Dyalog World

..or: How I Learned to Stop Worrying and Love **DML**

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# Disclaimer

- All the dates, version numbers and features are based on how I happen to remember them!
- I use the following rating from my personal point of view:
  -  a useful feature
  -  a nice feature, good to have in the language
  -  a more or less annoying feature
- And, of course: **□ML←3**

# Douglas Adams

(author, “*Hitchhiker’s Guide to the Galaxy*”)

”I’ve come up with a set of rules that describe our reactions to technologies:

1. Anything that is **in the world when you’re born** is normal and ordinary and is just a natural part of the way the world works.
2. Anything that’s **invented between you’re fifteen and thirty-five** is new and exciting and revolutionary and you can probably get a career in it.
3. **Anything invented after you’re thirty-five** is against the natural order of things.”

# My APL CV

- 1981: APL\3000 (LUT)
- 1985: VSAPL, APLVSPC (IBM)
- 1986: **APL2** (State Computing Centre, **PSP Bank**)
- 1988: APL\*PLUS/PC (TVO Nuclear plant)
- 1990: **APL2/PC**
- 1992: APLI386
- 1993: ISIAPL/W, J
- 1994: APL2/OS2, APL\*PLUS II
- 1995: DyalogAPL 6.3, APL\*PLUS III (PSP)
- 1996: **DyalogAPL 7.1** (AJ Consulting, **Statistics Finland**)

# Why APL?

- Simple
- Consistent
- Intuitive
- Fun

*“Everybody knows APL, they just don’t know it yet”*

– Dr. Alexander Skoromokhov (Sasha)

# APL2

- Logical and natural extension to VSAPL
  - *APL2 Programming: Language Reference*
- Program control: nothing new 🙄🙄
  - (VEC=RC) / L1 L2 L3 L0
  - L9 [ 0 ∈ ρ DT
  - ⊕ ( 0 = □ NC ' DATA ' ) / ' DATA ← 0 0 ρ 0 '
- Mainframe environment
  - 16MB workspaces!
  - Full screen applications (APE)
  - Auxiliary processors with shared variables
    - User commands: 101
    - GDDM: 126
    - SQL/DB2: **127** 👍👍

```

[0]  W ESRPRINT_F X:A;I:N;LIST;PAGE
[1]  A Print the file ESR.FLIST
[2]  A W: page length, default 256
[3]
[4]  ⚬(0=□NC'W')/'W+256'
[5]  ⚬(~DONE)/'A+1 RAP_HOST'DELETE ESR.FLIST''
[6]  N+†pX+63 PAGELENGTH W†[2]X
[7]  LIST+LEV 63 0 0 0 0 0
[8]  PAGE+'''', (€USER), '.ESR.FLIST''
[9]  OPENLIST(DONE+1)⇒'SHR' 'MOD'
[10] L0:I+0
[11] A+□SVR'TSOC'
[12] DATLI+'TS (TN W'
[13] CTLLI+'TS (CTL '
[14] →L1[ι2∧.=A+111 □SVO''DATLI' 'CTLLI'
[15] →0 MSG'AP111 PRINT ERROR. RETURN CODE:',⊘A
[16] L1:→L2[ι0∧.=A+DATLI,CTLLI
[17] L2:→L3[ιN<I+I+1
[18] DATLI+(□AV[193 140], '—')CHANGE X[I:]
[19] →L2[ι0=A+CTLLI
[20] →L3 MSG'WRITING ERROR ', (⊘A), ' IN LINE: ',⊘I
[21] L3:CLOSE_TS
[22] DONE+1

```

# APL2 Specific

- Editor

`▽FUN[ ]▽`

`[ 1.2 ], [ ⚡ ], [ /from/to ], ...` 🙄🙄

- Miscellaneous

- *Format by Example:* ' 60:00 ' ⚡ `⊞TS[4 5]` 🙄
- Functions are always ambivalent 👍
- Identity functions and prototypes
- Error trapping: `⊞EA`, `⊞EC`, `⊞ES`
- Trace and stop vectors: `TΔFUN`, `SΔFUN` 🙄
- Transfer files: `)OUT`, `)IN`, `⊞TF` 👍
- Superscript minus allowed in names (L<sup>B</sup>L<sup>-</sup>01)
- Diamond wasn't available 🙄



# Not So Intuitive APL2 Features

- *Partition*

1 2 3 1 2 3 ⍷ 'ABCDEF'

- I thought the result would be 'AD' 'BE' 'CF'

- ..**but** it turned out to be 'A' 'B' 'CD' 'E' 'F'

- *Replicate*

1 ⍴ 2 3 0 1 / 'ABCD' ↔ 'A BBBD' ?

- Dyadic operator binding 🙅

+ DOP A B C ↔ (+ DOP A) B C

- Jim *Brown* (Berlin 2000): “*What’s Wrong with APL2*”

- But still: robust and reliable!

# First Contact with DyalogAPL 6.3 (1995)

- GUI interface programming 👍👍👍

```
'WINDOW' □WC 'FORM'
```

```
'WINDOW' □WS 'BCOL' 128 128 128
```

- Excel connection (DDE with shared variables) 🙌🙌

- Tracer 👍👍👍

- Editor 👍👍

- Non-common clipboard shortcuts 🙌
- Constants are reformatted 🙌

- No native file tools 🙌

# Culture Shock

- Some old favourite functions behaved oddly 🙄🙄

↑, >, <, €, ≡

- New operators and functions, enhanced syntax 🙄

◦, ∴, ∪, ∩, ∫, ≠

ι, ↓, +, θ, ◇, [], plus←+, counter+←1

- Braces in function header

- Shy result {z}←fun x 👍

- Ambivalent left argument {y} fun x 🙄

- New system functions

□FMT 👍, □MONITOR 👍, □NA 👍👍, □SM, □TRAP 👍, □VFI 👍👍, □XT, ...

# Deviations: Vector Binding

- APL2:  $\leftrightarrow$  DyalogAPL:  
1 2 'ABC'[2]  $\leftrightarrow$  1 2('ABC'[2])  
A B C←1 2  $\leftrightarrow$  A B(C←1 2)  
(A B C)←1 2 3  $\leftrightarrow$  (A B C)←1 2 3  
A B C ←1 2 3
  - DyalogAPL:  
1 2 'abc'[2]  $\leftrightarrow$  2  
a b c←1 2  $\leftrightarrow$  LENGTH ERROR  
foo x←1 2 3  $\leftrightarrow$  either foo(x←1 2 3)  
or LENGTH ERROR
- ➔ vector assignment without parentheses  
is considered **really** harmful 🙄🙄🙄

# Deviations: Slash Symbol

- APL2: **always** an operator

`//(1 2 3) 'ABC'` ↔ SYNTAX ERROR

`⊞FX ⊃ 'Z←X F Y' 'Z←X/Y'`

`F/(1 2 3) 'ABC'` ↔ `⊞ 'ABBCCC'`

`↑F/(1 2 3) 'ABC'` ↔ `'ABBCCC'`

- DyalogAPL: **either** a function **or** an operator 🙅

`// (1 2 3) 'abcd'` ↔ `⊞ 'abbccc'`

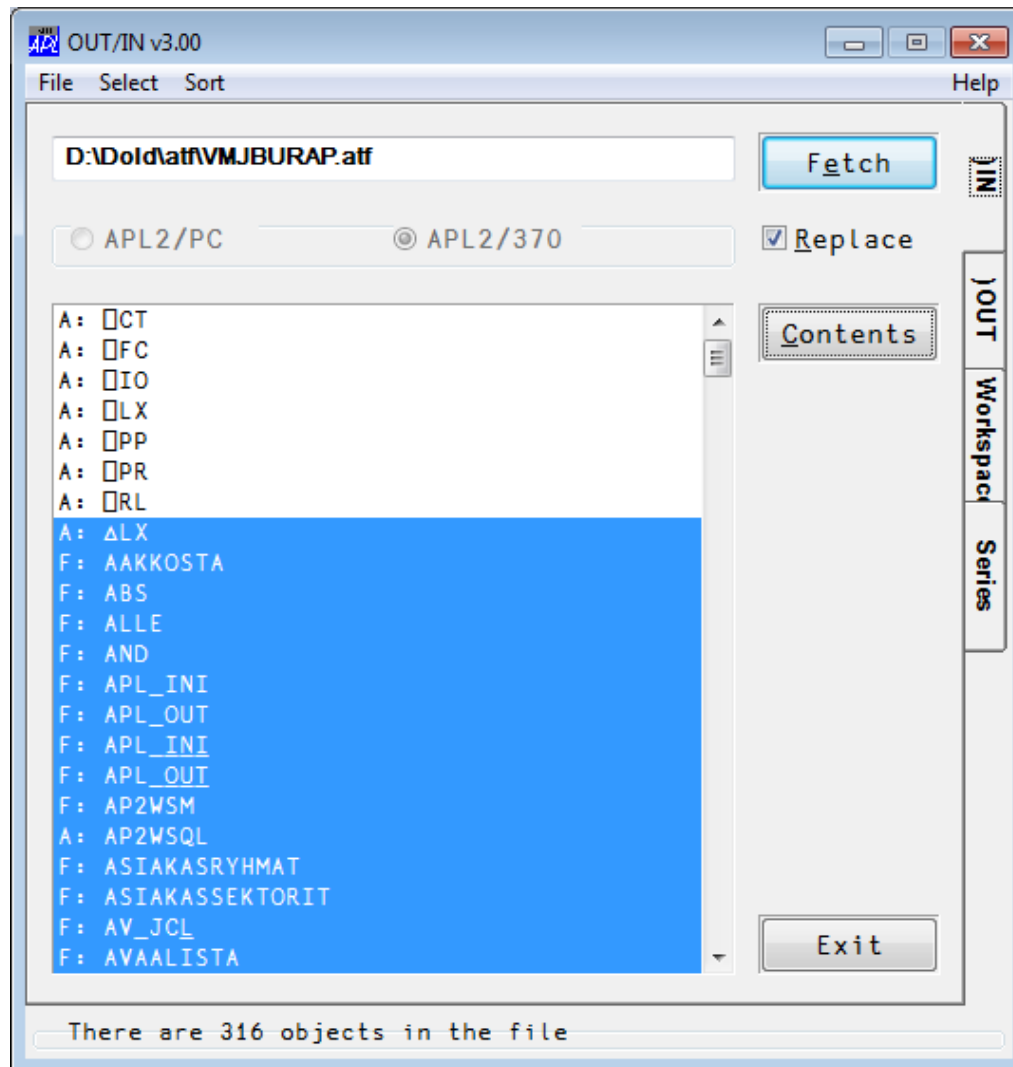
`↑ // (1 2 3) 'abcd'` ↔ LENGTH ERROR

`↑(//)(1 2 3) 'abcd'` ↔ `'abbccc'`

# DyalogAPL 7.1 - 8.0 (1996)

- **□ML** 👍👍👍
- **□N**-functions for native file handling 👍👍👍
- Namespaces 👍👍
  - The session namespace: **□SE** 👍
  - Workspace Explorer
- Control structures 👍👍👍
  - **:For, :If, ...**
  - **:Trap**
- New GUI objects 👍👍
  - **'Window.Table' □WC 'Grid' ('TitleHeight' 0)**

# Out In: Mainframe File Transferring



# DyalogAPL 7.3 - 9.0 (1997-2002)

- **D-functions** for functional programming 👍👍👍👍
- Namespace references: `Window.BCol[2]←0` 👍👍
- Threads: `&` 🖱️
- Support for idioms: 👍
- Syntax colouring 👍
- Session log 🖱️
- .NET 🖱️🖱️🖱️
- PocketAPL 🖱️
- Adrian: *RainPro* 👍👍



# 2000: Astika/W (Time Series Database)

The screenshot displays the Astika/W software interface, which is used for managing time series data. It consists of several overlapping windows:

- Statistics Finland - ASTIKA [2.3.16-285]:** The main application window. The left pane shows a hierarchical tree view of data series. The right pane shows a table of data for the selected series.
- Population data since 1749 - Right button for Menu, Left button zooms:** A window displaying a line chart of population data from 1749 to 2005. The chart shows a steady upward trend in population over time.
- Data: 1:** A window displaying a table of data for the selected series. The table includes columns for the year and values for various series.

The following table represents the data shown in the 'Data: 1' window:

Series header	1749	1750	1751	1752	1753	1754	1755	1756	1
55000 Population at year's end	410400	421537	429912	437633	445327	450141	457838	462562	47
55002 Deaths	11600	11300	10475	11400	11502	15696	13928	16724	1
55001 Births	16700	17800	18850	19395	19472	20786	21273	21097	2
55005 Natural population growth	5100	6500	8375	7995	7970	5090	7345	4373	

# 2001: PX-Edit (Statistical Table Editor)

The screenshot shows the PX-Edit 2003.2.0 software interface. The main window displays a statistical table with the following data:

	All offences	Offences against the Penal Code	Manslaughter/homicide/murder	Attempted
1999	742088		509606	142
1998	743260			
1997	722000			
1996	749842			
1995	757465			
1994	754542			
1993	800334			
1992	818362			
1991	799193			
1990	848978			
1989	806723			
1988	741443			
1987	731071			
1986	698762			
1985	656400			
1984	654978			
1983	584680			
1982	525218			
1981	508617			

The status bar at the bottom of the main window indicates: 50 rows x 12 columns = 600 figures.

An overlaid window titled "[1] Offences muuttujina time ja type of offence" is open, showing a metadata editor. It has a menu bar with: Keywords | Meta part | View | Select | Sort | Values | Add | Search | Mask. The editor contains two tables:

keyword	value
CHARSET	ANSI
AXIS-VERSION	1.5
MATRIX	RI01E
SUBJECT-AREA	Offences
SUBJECT-CODE	OF
TITLE	Offences muuttujina time ja type of offence
LANGUAGE	
CONTENTS	Offences
DESCRIPTION	Offences by type 1998

keyword	time	type of offence
ELIMINATION		All offences
DOMAIN		
KEYS		
NOTE		
NOTEX		
PRETEXT		
MAP		
DOUBLECOLUMN		

Buttons at the bottom of the overlaid window are: Title, Defaults, Fetch.., and Close.

# DyalogAPL 10.0 – 11.0 (2003-2005)

- Function header enhancement

( a b c ) ← fun ( x y z ) 👍 (still waiting for { a b c } ← ...)

- New or enhanced operators and functions: ✖ 👉 , □ , ∨ , ^

- Runtimes ( .exe ) 👍 👍 👍

- Objects: □NEW 👉 👉

- File Mapping: □MAP 👍 👍

- Name classes: □NC< 👉 , □NL ^3.2 👉

- Auto Complete 👍 👍

- The First Dyalog Conference

- **Gitte & Morten** 👍 👍 👍

# DyalogAPL 12.0 – 12.1 (2008-2009)

- **Unicode** 👍👍👍
- **□XML** 👍
- *I-beam* **I** ✎
- Event Viewer 👍👍
- *LanguageBar* ✎
- **APL#**
- **SALT**
  - ]user commands 👍
- **Conga** ✎
- **Legrand: “Mastering Dyalog APL”** 👍👍

# PX-Edit 3.0

The screenshot displays the PX-Edit 2012.3.0 software interface. The main window shows a list of municipalities on the left and a data table on the right. A dialog box for editing metadata is open in the foreground.

**Metadata Dialog Box:**

- Language: ru
- Table: [1] Нарушение 1950-1999 по время и тип нарушение
- Columns:
 

திறவு சொல்	மதிப்பு
CHARSET	ANSI
AXIS-VERSION	2000
LANGUAGE	ru
LANGUAGES	
CREATION-DATE	20000316 09:00
DIRECTORY-PATH	
DECIMALS	0
SHOWDECIMALS	0
MATRIX	RI01E
SUBJECT-CODE	OF
SUBJECT-AREA	Нарушение
COPYRIGHT	
DESCRIPTION	Типы нарушение в 1998
TITLE	Нарушение 1950-1999 по время и тип нару...
CONTENTS	Нарушение 1950-1999

**Main Data Table:**

செல் குறியீடுகள்	மதிப்பு	செல் குறியீடுகள்	மதிப்பு	செல் குறியீடுகள்	மதிப்பு
selja	0 / 779	undirvísitala	0 / 242	779	
dine	0 / 15	mánuður	0 / 61	76	

# DyalogAPL 13.0 – 13.2 (2011-2013)

- **□PROFILE** 👍👍 (why not shy result?)
- **□DMX**
- New functions, enhancements: **←**, **↳** 👍, **↑**, **↓**, **□**
- New operators (*RegEx* 🖱️): **□R**, **□S**, **□:**
- Complex numbers 🖱️ (not the angular types: **1D2** or **1R2**)
- Renewed random number generator 🖱️
- IME keyboards for Unicode input 👍👍
- [TryAPL.com](http://TryAPL.com), [TryAPL.org](http://TryAPL.org) 👍👍
- MiServer 🖱️
- *Array Editor* 🖱️

# The Current Finnish IME Keyboard

½	⊕	!	⊥	"	⊙	#	⊘	⌘	⊗	%	⊙	&	÷	/	⁄	(	∞	)	ψ	=	≠	?	⋈	`	ÿ
§	◇	1	¨	2	@	3	£	4	\$	5	€	6	¥	7	{	8	[	9	]	0	}	+	\	'	ÿ
Q	≠	W	ω	E	ε	R	√	T	↓	Y	ψ	U	∩	I	⊥	O	⊙	P	⊕	Å	→	^	¨		
q	≡	w	ω	e	ε	r	ρ	t	↑	y	⋈	u	∪	i	⊥	o	⊙	p	⊕	å	←	¨	~		
A	α	S	∏	D	Δ	F	∇	G	≥	H	⊠	J	⊣	K	⊥	L	□	Ö	ö	Ä	⊘	*	⋈		
a	α	s	∑	d	Δ	f	∇	g	≤	h	⊠	j	⊣	k	⊥	l	□	ö	ö	ä	⊘	'	□		
>		Z	≥	X	÷	C	⊃	V	∇	B	∩	N	≈	M	⌈	;	;	:	⊠	-	†				
<		z	≤	x	×	c	⊂	v	∇	b	∩	n	~	m	⌋	,	∅	.	⊠	-	-				

# DyalogAPL 14.0 – 14.1 (2014 - 2015)

- Function trains: ( + / ÷ ≠ ) 👍
- (Bytecode) Compiler control 🙌
- Tally: ≠ 👍 👍
- Rank: ∘ 🙌
- Key: ⍳ 👍
  - Unique items of a vector: -⍳ vector
  - Unique rows of a matrix: -⍳ matrix
- Row index of (enhanced ⍵) 👍
- Inverted table index-of: 8⍲ 🙌
- JSON support 👍



# DyalogAPL 15.0 (2016)

- Performance improvements 🍑🍑🍑
- **Free** Non-Commercial Licence 👍👍👍
- New native file functions 👍👍
  - ◻MKDIR, ◻NDELETE, ◻NEXISTS, ◻NGET, ◻NINFO, ◻NPARTS, ◻NPUT
- Case conversion: (819I) array 👍👍

# The Future Is Worth Waiting for... (2016- )

- Isolates and Futures 🙌
  - $\times$ ,  $\parallel$ ,  $\odot$
- New operators and functions
  - $\ddot{\tau}$ ,  $\ddot{\nu}$ ,  $\phi$ ,  $@$ ,  $\psi$ ,  $\boxplus$ ,  $\underline{\tau}$ 👍,  $\neq$ 👍,  $\subseteq$
- Rational numbers: 1597r987 355r113
- Primes:  $\dagger$