6-man chess and zugzwangs

Article

Accepted Version

It is advisable to refer to the publisher's version if you intend to cite from the work. See Guidance on citing.

www.reading.ac.uk/centaur

CentAUR

6-man Chess and Zugzwangs

Guy Haworth

guy.haworth@bnc.oxon.org

Topics ….

- **Endgame tables, EGTs**

- **The Zugzwang: derivation, definition(s), levels, types, examples**

- **The *en passant* zugzwang**

- **The Zugzwang review: listing, counting, statistics**

- **Some gems:**

  - **deepest zugs, unique zugs, *e.p. zugs*, type 4-6 zugs, 5-1p zugs**

  - **Adding castling rights: cancels zug, no difference, creates zug**

- **Zugzwangs in Studies**

- **Challenges for the future**

Endgame Tables

- **Chess is a sequence of (partially) ordered phases: ∴ EGTs possible**

  - ➤ **KQP(a6)KQ – KQP(a7)KQ – KQQKQ – KQQK - KQK**

- **Nalimov's 'Depth to Mate' (DTM) EGTs are well known**

  - ➤ **3- to 5-man and some 6-man EGTs purchasable from, e.g., Chessbase**

  - ➤ **Being shared on p2p networks, e.g. emule, kd.lab.nig.ac.jp/chess/tablebases-online/**

  - ➤ **Bleicher and Tamplin provide EGT Query Services**

    - **www.k4it.de/index.php?topic=egtb&lang=en, chess.jaet.org/endings/**

- **DTM EGTs assume winner is minimising, and loser maximising, DTM**

- **Other metrics exist: DT Conversion, DT (move-count) Zeroing (move)**

- **Yakov Konoval's algorithm (run by Marc B) and code are faster**

 - ➤ **KQPKQ can be generated in 10 minutes on a single processor**

The Zugzwang

- *Zugzwang* … 'pressure to take action', hence in chess …

- Definition: a position where the side to move would rather 'pass'

- However, the Oxford Companion to Chess says:

  - 'A position in which **whoever** has the move would obtain a worse result than if it were the opponent's turn to play'

  - 'whoever' suggests that either side can be considered 'on move'

- Proposed redefinition of a *Zugzwang Position*:

  - One in which the side to move would rather play a *Null Move*

  - Anticipates the case when position *p1* includes possible *e.p. capture*

- Levels of Zugzwang: A, B, C

Levels and Types of Zugzwang

- **Levels of Zugzwang:**

  - ➢ **A: -ve impact on theoretical value**

  - ➢ **B: -ve impact on number of moves to some 'win goal'** ($\Rightarrow$ e.g. Δ)

  - ➢ **C: -ve impact on prospects of a better result**

- **Nomenclature:**

  - ➢ **'Before'   A ≡ *Reciprocal Zug*, B ≡ *Squeeze***

  - ➢ **'After' ?   A ≡ *Strong Zug,* B ≡ *Weak Zug*, C ≡ ? … *Bronze***

- **Focus here on Level A Zugs: three familiar types**

  - ➢ **type 1: 1st player draws – wins – draws (121)**

  - ➢ **type 2: 1st player loses – draws – loses (010)**

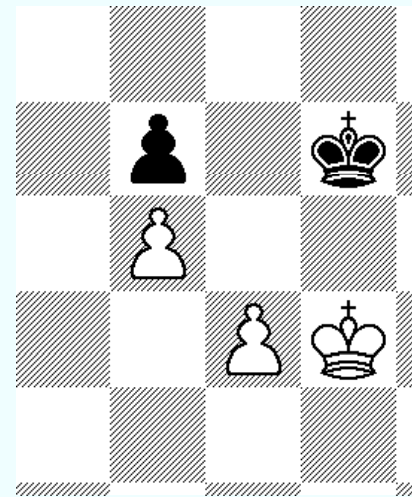 - ➢ **type 3: 1st players loses – wins – draw (020), the *full point zug***
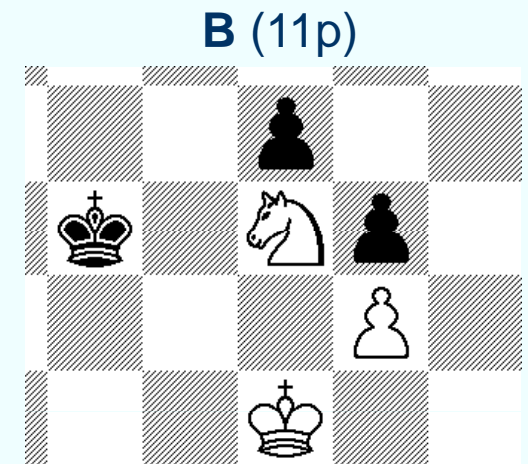
Examples of Level A1-A3, B and (?) C zugs
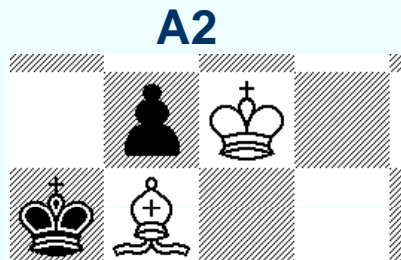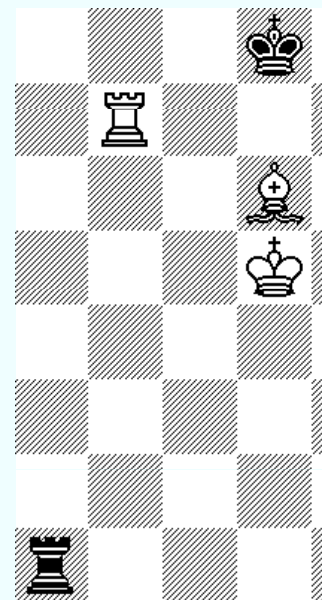

A1

A3

A2

**B** (5p)
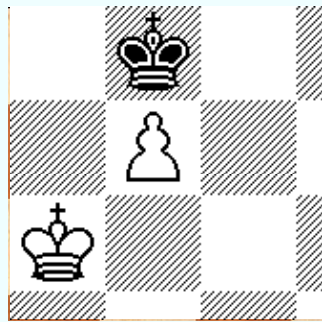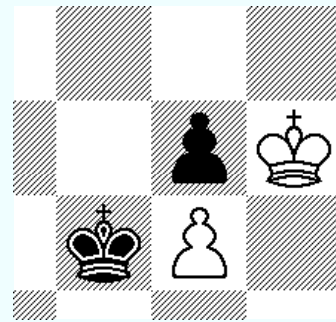
B (11p)

JN *SOPE* #301
Lobron-Spas(s)ov
(1993) p63b:
C? but …
1. Bc7+ Kc8''''

Mandler (1924),
#5.1, p3w/8b

The *en passant* zugzwang

- **Who first documented *en passant* featuring in a zug?**
  - ➢ **? Elkies, *On Numbers and Endgames*. In GONC (1996)**
  - ➢ **Not visible to GH (2000) in a review of received positions**
- **Given the zug's positions *p1*, *p2* and *p3* and an e.p. option in *p1*:**
  - ➢ **position *p2* does not feature *e.p.,* position *p3* =/= position *p1***
  - ➢ **to the 1st player, value(*p3*) may be <, = or > value(*p1*)**
  - ➢ **If value(*p3*) = value(*p1*), value(p3) < value(p2) …**
    - **this implies that the en passant capture option is not essential to the zug**
  - ➢ **Beyond the three previous types in which value(*p3)* = value(*p1) …***
    Three further types of zugzwang exist

Six types of zugzwang
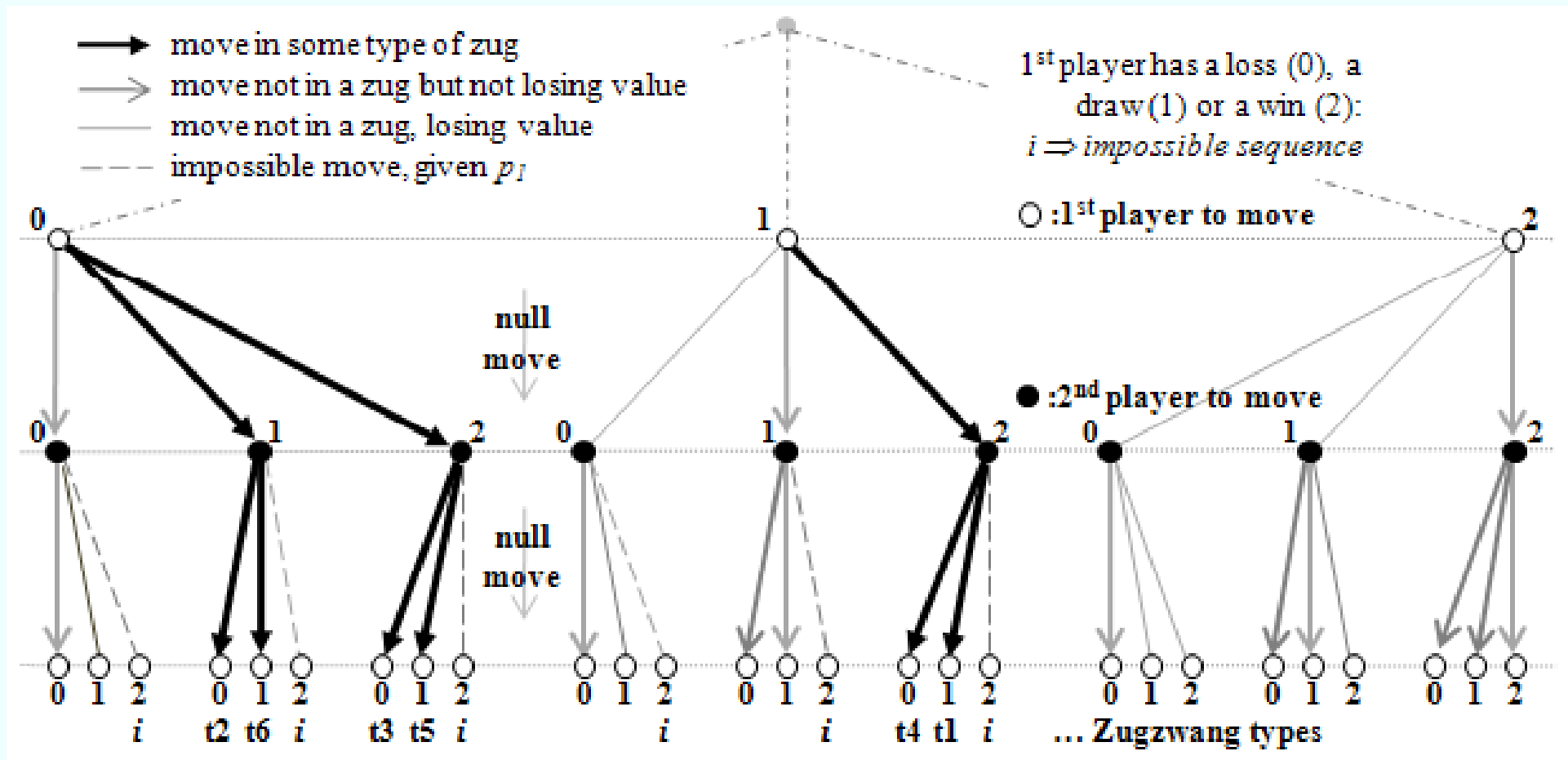
Listing and counting zugs

- **The lexical convention is that:**
  - **White has at least as many pieces as Black**
  - **Pieces are listed in 'strength order': K-Q-R-B-N-P**
  - **In an *m-m* endgame, White is 'lexically no less strong' than Black**
  - **Endgames are listed alphabetically within group (maybe P-less/P)**
- **1st player may be assumed to be White unless e.p. is present**
- **When the endgame force present is symmetric**, e.g. KPKP:
  - **type 2 zugs are equivalent to type 1 zugs** (taking *p2* as *p1* etc)
  - **most type 3 zugs pair off into pairs of equivalent positions**
    - **Only one of these is counted**
- **No attempt is made to identify positions which are unreachable**
- **No check is made on whether an e.p.-capture is legal or not**
- **Statistics and zuglists en route to the ICGA website *www.icga.org***

Headline Statistics

Item \ Group	3-3	4-2	5-1	3-3p	4-2p	5-1p	Total
Endgames	55	80	35	65	95	35	365
No zugs	12	50	35	12	29	28	138
No t1 zugs	12	50	35	12	30	28	139
No t2 zugs	31 (+ 9)	71	—	22 (+ 3)	51	—	175 (+ 12)
No t3 zugs	55	80	—	50	67	—	252
A unique zug	4	1	0	1	2	0	8
One t1 zug	4	1	0	1	4	0	10
One t2 zug	1	2	—	1	6	—	10
One t3 zug	0	0	—	6	3	—	9
t1-t6 zugs	27,597	20,017	0	379,218	478,682	293	905,807
t1 zugs	27,470	8,434	0	361,712	373,479	293	771,388
t2 zugs	127	11,583	—	15,543	105,069	—	132,322
t3 zugs	0	0	—	1,568	133	—	1,701
t4 zugs	—	—	—	394	0	—	394
t5 zugs	—	—	—	0	0	—	0
t6 zugs	—	—	—	1	1	—	2

Statistics: en passant zugs

Endgame	e.p.-zugs wtm	e.p.-zugs btm	Type 1 wtm	Type 1 btm	Type 2 wtm	Type 2 btm	Type 3 wtm	Type 3 btm	Type 4 wtm	Type 4 btm	Type 5 wtm	Type 5 btm	Type 6 wtm	Type 6 btm
KPPKP	35	20	35	0	0	20	0	0	0	0	0	0	0	0
KBPKBP	10	——	10	——	0	——	0	——	0	——	0	——	0	——
KBPKNP	130	5	130	2	0	3	0	0	0	0	0	0	0	0
KBPKPP	18	18	18	4	0	13	0	0	0	1	0	0	0	0
KNPKNP	156	——	156	——	0	——	0	——	0	——	0	——	0	——
KNPKPP	250	19	250	17	0	2	0	0	0	0	0	0	0	0
KPPKPP	1,301	——	869	——	39	——	0	——	393	——	0	——	0	——
KQPKQP	75	——	72	——	3	——	0	——	0	——	0	——	0	——
KRPKBP	20	7	20	0	0	7	0	0	0	0	0	0	0	0
KRPKNP	27	14	27	0	0	14	0	0	0	0	0	0	0	0
KRPKPP	0	2	0	0	0	1	0	0	0	0	0	0	0	1
KBPPKP	1	0	1	0	0	0	0	0	0	0	0	0	0	0
KNPPKP	0	1	0	0	0	1	0	0	0	0	0	0	0	0
KPPPKP	8	2	8	0	0	1	0	0	0	0	0	0	0	1
Totals	**2,031**	**88**	**1,596**	**23**	**42**	**62**	**0**	**0**	**393**	**1**	**0**	**0**	**0**	**2**

Deepest zugs; absolutely unique zugs

id	Endgame	Position	Zug Type		val / DTM p1	p2	p3
D01	KRNKNN	4n3/2n5/8/8/8/3K4/5k2/2R1N3 w	1	121	=	+245	=
D02	KRBKNN	8/8/8/8/1nn5/2k5/4R3/K6B w	1	121	=	+228	=
D03	KRRPKQ	k3q3/8/8/2R5/6RP/8/8/1K6 w	1	121	=	+217	=
D04	KBNPKQ	k1K5/5N2/8/8/2Bq4/1P6/8/8 w	2	010	-211	=	-211
D05	KRNKNP	3nR3/8/8/8/1K6/8/2pkN3/8 w	1	121	=	+207	=
D06	KRNKBN	8/b7/7N/2n5/8/4R3/8/3K1k2 w	1	121	=	+199	=
D07	KBNPKP	8/3K2N1/8/8/6k1/1P1B4/6p1/8 w	2	010	-175	=	-175
D08	KRBKNP	K7/8/8/8/3n4/R6B/4kp2/8 w	1	121	=	+168	=
D09	KRNKBP	8/8/8/2K5/2N1k3/5p1R/8/4b3 w	1	121	=	+165	=
D10	KBBPKR	4B3/3K4/1B6/5rk1/8/8/6P1/8 w	1	121	=	+163	=
U01	KQNKBN	8/8/8/8/8/nkb5/1N6/Q1K5 w	1	121	=	+35	=
U02	KQNKNN	8/8/8/n1Q5/2n5/8/2kN4/K7 w	1	121	=	+35	=
U03	KQRKBB	8/8/6b1/2R5/3K4/4Q3/5b2/5k2 w	1	121	=	+26	=
U04	KQRKRB	2r5/R1Q5/b7/8/8/2K5/8/1k6 w	1	121	=	+17	=
U05	KRRRKQ	8/8/8/8/8/4q1k1/2R5/1R1K3R w	1	121	=	+22	=
U06	KQBKNP	8/1K6/8/2k5/Q1Bn4/8/2p5/8 w	1	121	=	+21	=
U07	KQBPKB	1k6/1P6/K7/1Q6/B1b5/8/8/8 w	1	121	=	+9	=
U08	KQBPKP	8/8/8/8/8/1p6/1PQ5/kBK5 w	1	121	=	+11	=

Some observations on e.p. zugs

- **Given the naming convention, Black may be 1st player**

- **The three new Types:**

  - **type 4: 1st player draws – wins – loses (120)**

    - **Not a good idea to play the null move in this position**

  - **type 5: 1st player loses – wins – draws** (with stalemate) **(021)**

    - **the only zugzwang in which the 1st player makes a net gain**

  - **type 6: 1st player loses – draws – draws** (with stalemate) **(011)**

- **In terms of just *p1/p2*, t4 $\rightarrow$ t1, t5 $\rightarrow$ t3 and t6 $\rightarrow$ t2**

- **Apart from 393 type 4, we have 1 type 4 and 2 type 6 zugs**

- **Elkies has provided an 11-man, 9-pawn type 5 zug: KP^{5}KP^4**

- **Is a position with an unusable e.p. capture opportunity different?**

2009-02-10: FIDE Article 9.2 … ??

9.2 The game is drawn, upon a correct claim by the player having the move, when the same position, for at least the third time (not necessarily by a repetition of moves)

a. is about to appear, if he first writes his move on his scoresheet and declares to the arbiter his intention to make this move, or

b. has just appeared, and the player claiming the draw has the move.

Positions as in (a) and (b) are considered the same, if the same player has the move, pieces of the same kind and colour occupy the same squares, and the **possible moves** of all the pieces of both players are the same.

Positions are not the same if a pawn that could have been captured en passant can no longer be captured in this manner. When a king or a rook is forced to move, it will lose its castling rights, if any, only after it is moved.

But Articles **6.10**, **7.4**, **9.6** and **B3.c** use the phrase **possible series of legal moves**!

Two types of (e.p.) zugzwang in KPPKP
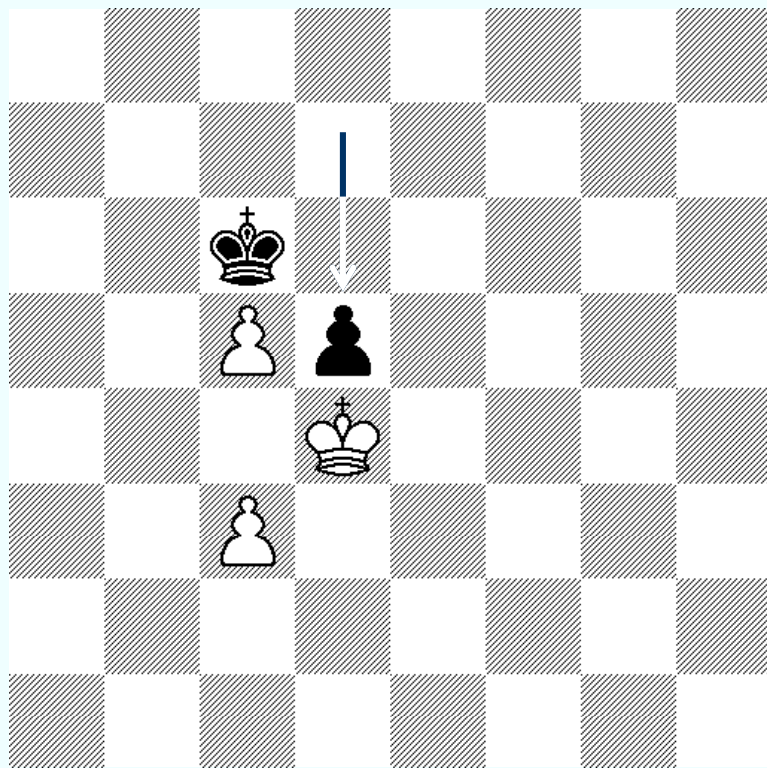
t1 (121) wtm KPPKP zug (e.p. or not)
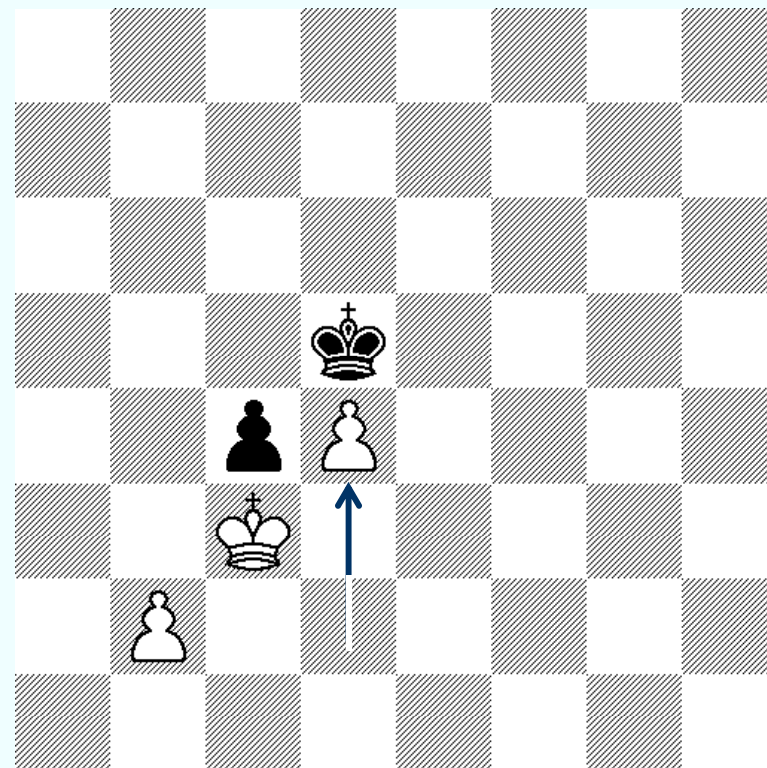
t2 (010) btm KPPKP zug (e.p. or not)

dtm = -25 with e.p., -15 without

Unique type 4 and type 5 zugs

t4 (120) btm KBPKPP zug
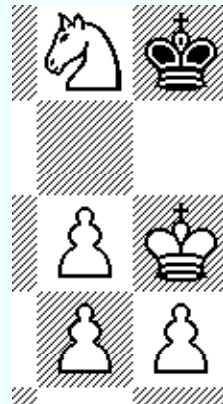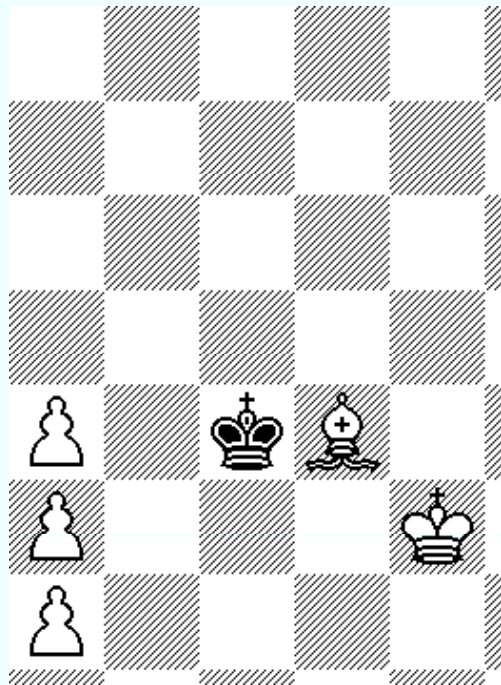

t5 (021) btm KP^{5}KP^4 zug … NDE

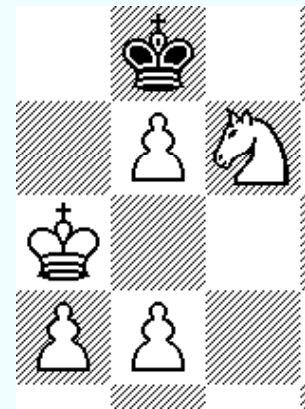# The two known type 6 zugs
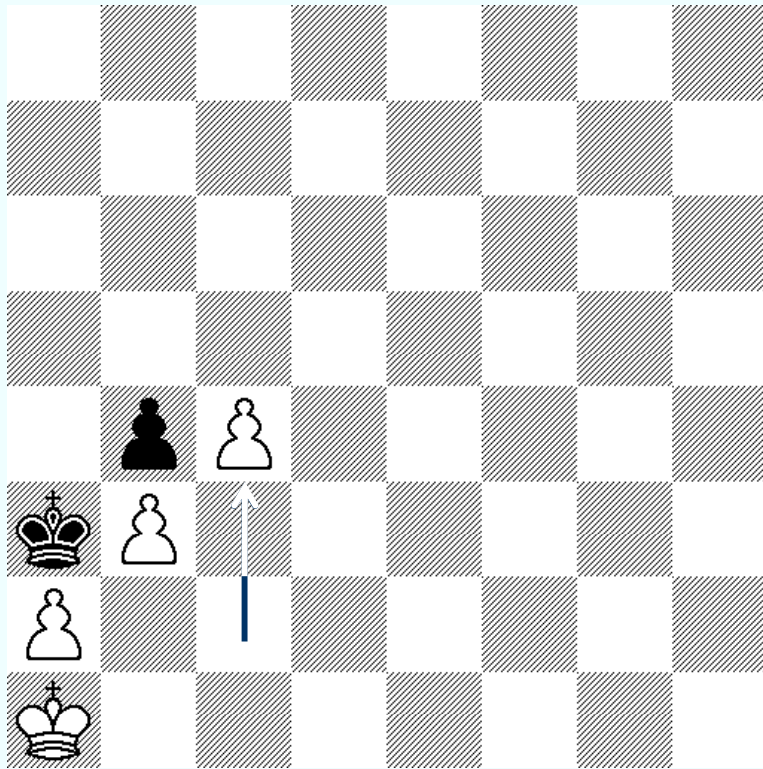
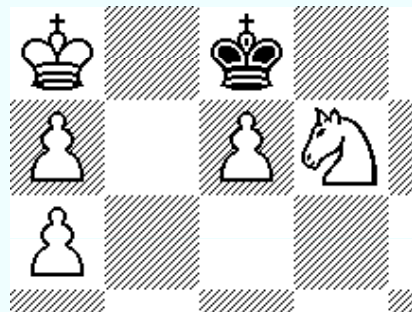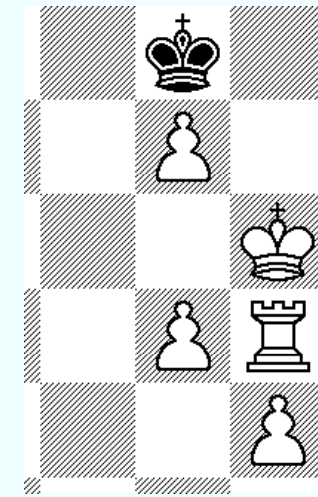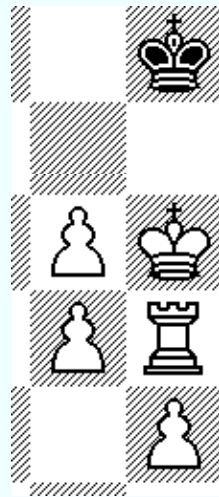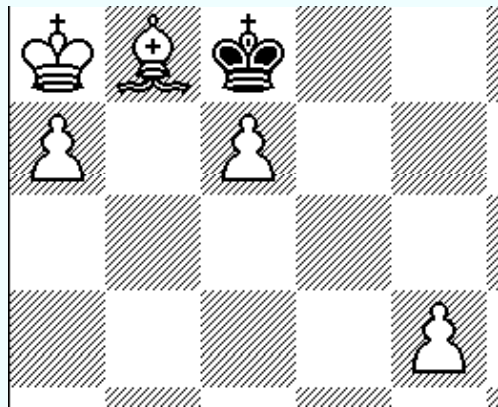t6 (011) btm KPPPKP zug
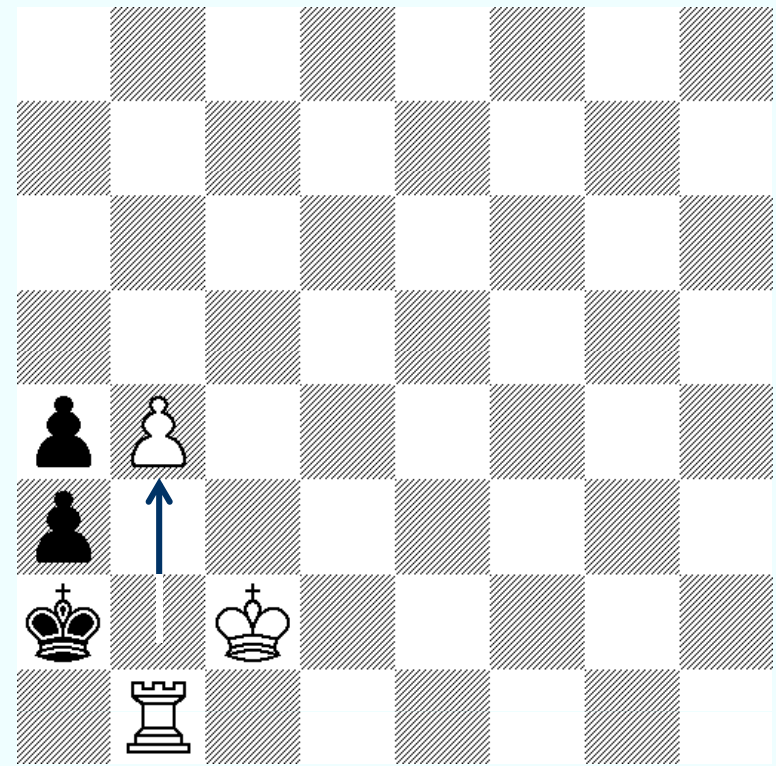
t6 (011) btm KRPKPP zug

5-1p zugzwangs, Part 1
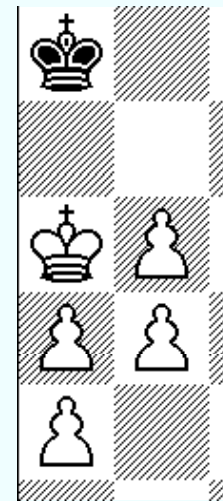
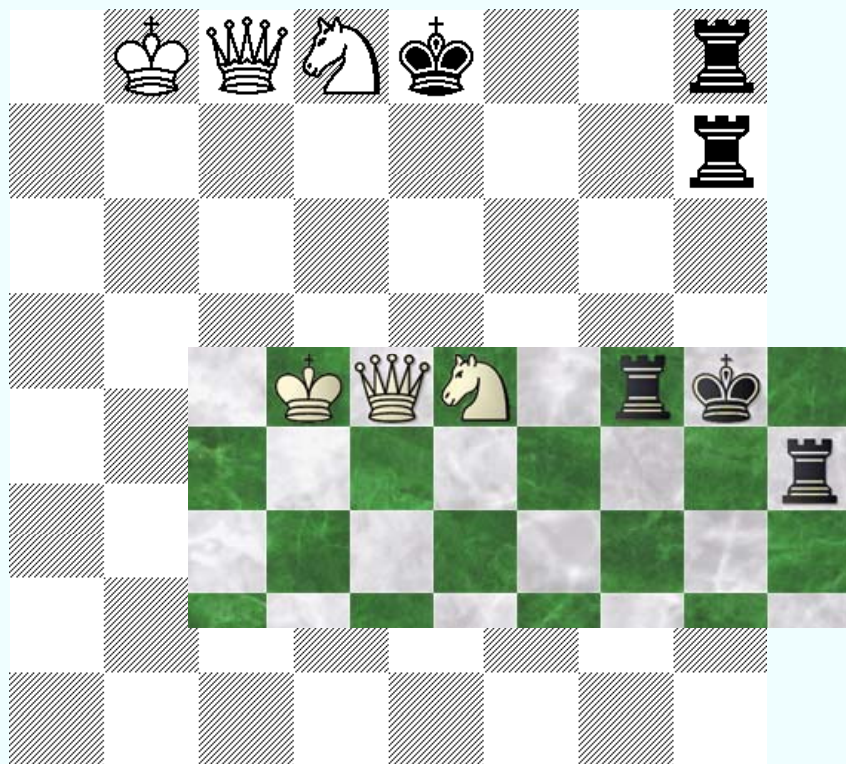293 (type 1) 5-1p zugs in 7 endgames: K(B/N/P/R)PPPK and K(Q/R/B)NPPK[**]
[**] 174 = 3*58 'wrong footed Knight' zugs; (unavoidable) stalemates
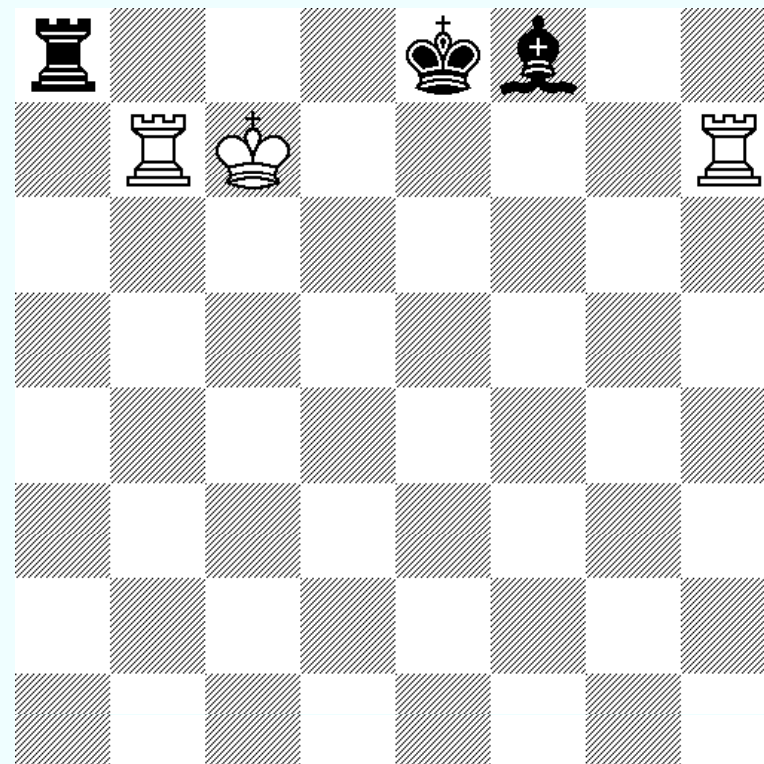
5-1p zugzwangs, Part 2

Counts: KBPPPK (11), KNPPPK (89), KPPPPK (17), KRPPPK (2);
KBNPPK (58), KQNPPK (58), KRNPPK (58) – Knight's tours?

Added Castling Rights … 1.6‰ of R-positions



t1 (121) wtm KQNKRR zug
(but 1…O-O draws)

t1 (121) wtm KRRKRB zug
1. … B(a3/c5/e7) 2. Rh8 Bf8

Added castling rights does not reduce theoretical value for the beneficiary

Zugzwangs in Studies … and Aesthetics

- **Review level A zugs in the study corpus**
- **Identify all 'Reciprocal zugzwang studies'**
  - ➢ **John Beasley, *Creating reciprocal zugzwang studies.***
    EBUR 12-2, 8—12 (2000)
  - ➢ **Level A zugs featuring in both the main line and a plausible *try***
- **Identify Level B zugs in EGTs and in the study corpus**
  - ➢ **Level B zug featuring twice in the main line**
  - ➢ **wtm position *BZ* has to lead to btm position *BZ* for the win**
- **Identify a Level C zug, given a model of a fallible player**

- **Aesthetics of zugzwangs?**
  - ➢ **Factors of the position?**
  - ➢ **Factors of the context** (clearly relevant) **?**

(Reciprocal) Zugzwang Studies
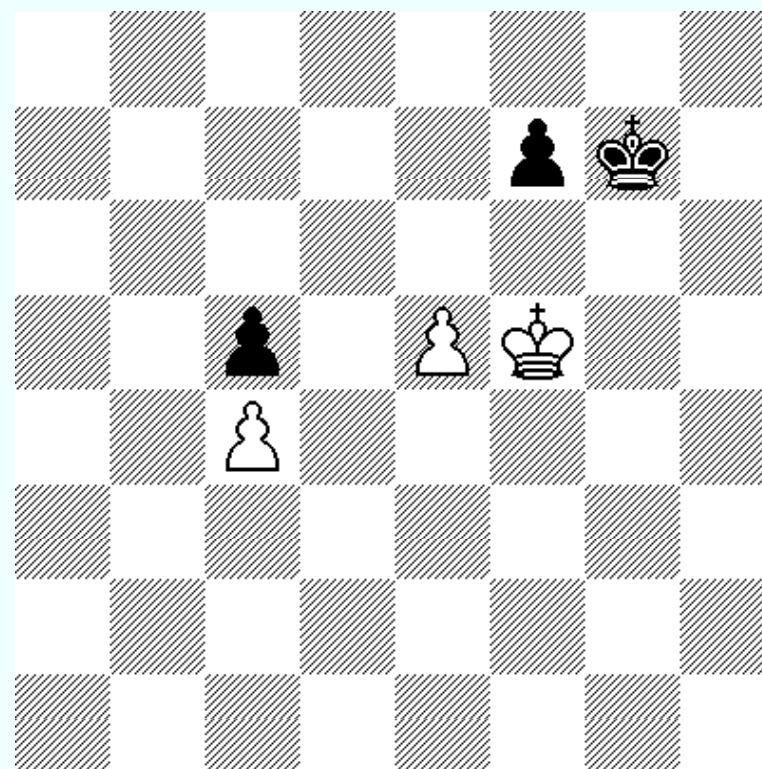

Zugs and SEA, v8.1, 2009-04-03
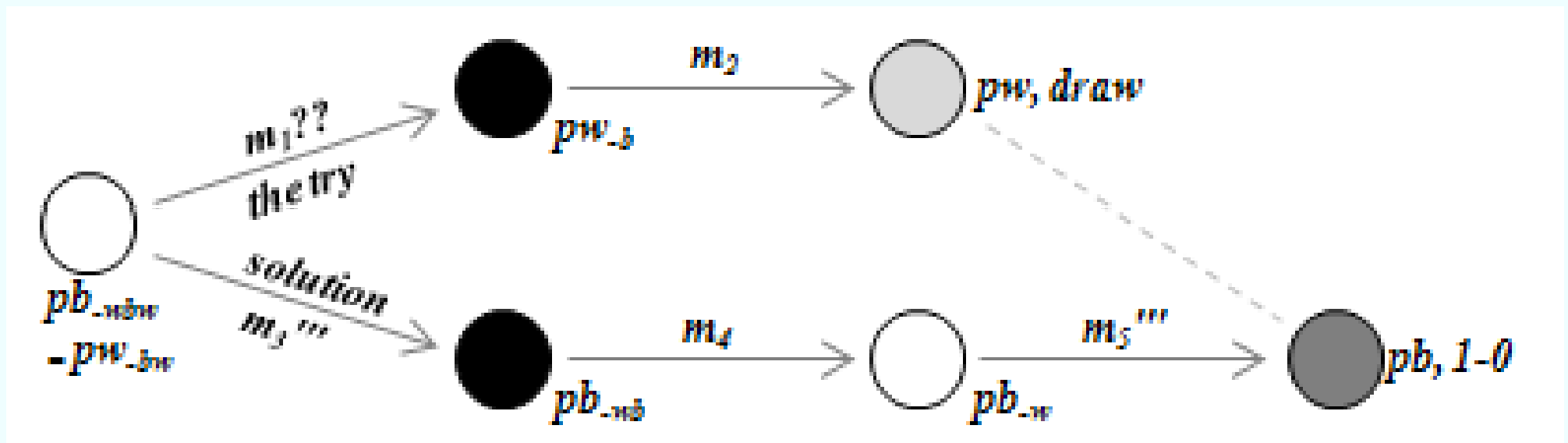
JB: Zugzwangs in 'Zugzwang Studies'
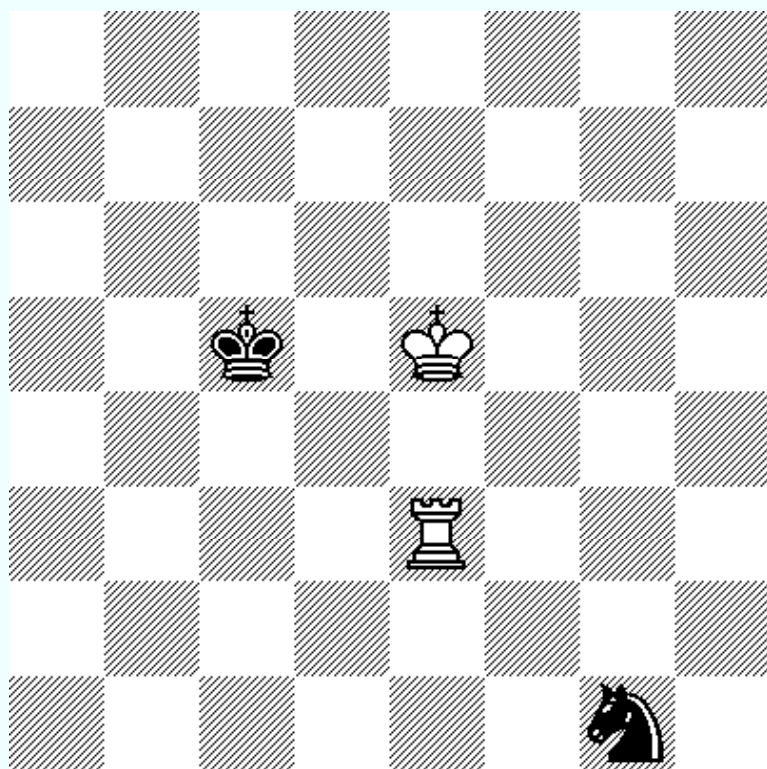
JB, EBUR #2
1. Kf5' (1. Kf4?? Kd4 pw=) Kd4'
2. Kf4'''' pb 1-0

JB, EBUR #4
1. Kf4'''' (1. Ke4?? Kg6'' pw=) Kg6'
2. Ke4'''' pb 1-0

Zugzwang Challenges

- **Statistical**
  - ➢ **Review the YK/MB 'DTC' zugzwang results**
  - ➢ **Generate and review EGTs for positions with castling rights**

- **Datamining for Gems**
  - ➢ **a type 3 7-man zug with no Pawns, Knights or obtrusive force**
  - ➢ **type 3 e.p. and type 5 zugs with less men and/or less Pawns**
  - ➢ **A zug where the presence of castling rights is *key* to the zug**
  - ➢ **Find *Knight's Tour* crocodiles of 3-1p and 5-1p zugs**

- **Studies**
  - ➢ **Identify Level A and B zugs in the existing study corpus**
  - ➢ **Identify which Level A and B zugs could be central to studies**

Spare